CONTINGENCY AND DIVINE ACTIVITY: TOWARD A CONTEMPORARY CONCEPTION OF DIVINE INVOLVEMENT IN AN EVOLUTIONARY WORLD

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Abstract

Contingency and Divine Activity:
Toward A Contemporary Conception of Divine Involvement in an Evolutionary World

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In this dissertation, I adopt a view that is heavily influenced by Thomas Jay Oord's theory of divine influence (what I label throughout as "involvement"). Specifically, there are three features of his theorizing that I will affirm in these pages (see chapter 6): (1) that love is the preeminent attribute of God's person; (2) that God's love amounts to a giving of himself to the entities that fill the natural world; and (3) that God does not control the responses of his entities in response to love bestowed by him toward them. However, I will augment—and thereby go beyond—his view and tighten his theses (thereby making his argument stronger) by the advocation of certain features (or elements) of evolutionary biology, particularly: the strong(er) advocation of contingency, and the postulation of punctuated equilibrium being the modality by which the advancement of species is effected, which are both derived from dialogue with Stephen Jay Gould (see chapter 2). Further, I will—from Michael Ruse—take the idea that "progress" in evolutionary biology is an ever-maligned, yet ever-present, notion that must be reckoned with in any theological framework for contemporary society, to which Oord speaks (see chapter 3). Moreover, from Conway Morris, I will counteract—or perhaps better, counterbalance—the radical contingentist position of Stephen Jay Gould insomuch as I will attempt to strike a somewhat "middle-way" betwixt the two (see chapter 4). Still further, I will augment Oord's positions by narrowing in on a (more) palatable notion of teleology for the contemporary environment by dialogue with Charles Sanders Peirce's "evolutionary developmental philosophy," which will add more "meat" to what I perceive to be a lacking in

Oord's theological postulates (see chapter 5). Moreover, I will partially criticize Oord for his underdeveloped theory of divine involvement. After all, if all things are done in and through love, what then is actually done? That is, what is distinctly done by love, versus what is not done by love (so to speak)? If all things are loving, how might one distinguish it, in other words?

Acknowledgments

I apologize to my reader in advance for this inordinately extended and elongated acknowledgements section, but (most) people only a write a dissertation once in their lifetime, and I want to make sure I give the proper weight to various people's involvement with and influence upon me during my walk by inches toward this milestone. That said, allow me to go back in time a little while, to positively note those people—particularly men—in my life that have greatly involved themselves with my spiritual well-being throughout the years in my incipient inch-by-tiny-inch journey toward Christlikeness.

Whenever I deposit myself in a new locale—and without question, I have traveled all around the USA, East to West—I always, without fail, seek out older men to "teach" and "model" manhood to me. I find, particularly, that the generation prior to the Baby-boomers fill this niche for me real-well. This generation, in fact, specifically teaches me a lot about being a man myself. The "fifties male," as they are sometimes referred to as—which I here use to encompass men born prior to the 1950s and thereby reaching at least young adult status before 1959 C.E.—has an underlying strength about them that later generations of men—seemingly—just do not possess. I exploit that, frankly, and sit at their proverbial feet to "learn" manhood thereby.

So then, when I was in Hawkinsville, GA, for example, I had an association with the aged Wilson Joiner from my "home" church, First Baptist Hawkinsville; thereafter, when I was employed at Emergent Genetics in Albany, GA, and attending Central Baptist Church there as well, I met regularly with George Bridges at his "Trophy Shop" to talk about nothing, really, but just to "watch and listen" instead; then, when I was in Sycamore, GA, at my first church as a preacher, I met regularly with Leion Smith, who died a few years thereafter, and to who's funeral

I traveled from my then-home in Virginia to preach (circa 2008 C.E.). After this period of time, when I was at my second church as a preacher in Macon, GA, I met regularly with the extremely learned Dr. Michael Muth at various coffeeshops to chat about life and my then-current desire to pursue a PhD, and he very much so encouraged me to do so (note: in consideration of this last fifteen-year journey, I perhaps should not thank him after all… just teasing). Moreover, when I was in Barnesville, GA, at my third church as a preacher, I met very much regularly with Mercer Bush, particularly at the "Red Rooster café"—notably not only was he the board chairman of my then-current position at Fredonia Church, but also remains a great friend to this day. What's more, when I was located in "Hampton Roads" Virginia, during my first PhD program, I met regularly with my close friend, fellow PhD student, and pastor Jim Williams—we usually chatted about some obscure point of Wesleyan theology or history that I had no conception of (but it was fun to listen). And finally, since I have been located in California at my latest "depot," I have met regularly with both Granville Henry & John Tessier, who were (in the first case) and are (in the second case) members of Our Lady of the Assumption Catholic Church, in downtown Claremont.

Notably, John was and is very "intentional" in his meetings with me: we do not talk gossip, but he instead shares with me "what-it-takes" to prosper in life, all the while raising a family, working toward holiness, and balancing work at the same time. I look forward to many more "coffee breaks," early in the morning, with John in the future. Unfortunately, Granville has recently passed-away, and as such our interaction and involvement has drawn to a close. However, Granville taught me a lot about being scholar and a gentleman. Granville always, moreover, had very supportive "stuff" to say about my own academic progress, which was at times—I contend anyway—entirely *un*warranted. He nevertheless promoted my scholarship with

his circle of friends to no end. He and I were to write at least one peer-reviewed article together, but unfortunately this particular occurrence did not transpire before he ultimately passed-away. Granville, one might say, is another victim of Covid 19 in this contemporary era—*not* because he died from it (which he did not!), but because he was one of those unfortunate people that were forced into hermetically sealed seclusion for nearly the last eighteen calendar months. What a tragedy. I'll miss my good friend. Un-hesitantly, I would like to dedicate this dissertation to the memory of Granville Henry, as a celebration of both his involvement and influence in my own life.

That said, I would also like to offer thanks to and for Archie & Susan Brown—Archie for always having an ear to hear on our little walks around the farm—and mother for giving birth to me once, and then "raising me twice;" Dr. Philip Clayton for being a close friend, academic mentor, and challenging me to write a dissertation (or, "book") that will "remain," not merely collect dust—and, of course, for "taking me across the finish line;" Dr. Ingolf Dalferth for his modeling a professional professor to me, as well as his critical comments on a previous instantiation of this dissertation; Dr. Roland Faber for his prodding me to pursue more heavily Whitehead studies, along with his critical comments on a previous instantiation of this dissertation; K. C. Hanson for "cleaning up" this dissertation as my editor at Pickwick for the book that shall result from it; Dr. Thomas Jay Oord for being my supportive friend, and inspiring me—at rudiment—to write this dissertation; Dr. Michael Ruse for stimulating me biologically for years with well-written, tightly-argued books, as well as proffering a Foreword to the book that will follow from this dissertation, even though it arrives at conclusions that he himself might not support; Jim Tedrick, CEO at Wipf and Stock, for giving me another second chance, and in fact a book contract on a dissertation that was yet-to-be-written (how fortunate am I!); and Dr.

Amos Yong for being my first academic mentor, thereby bringing me from “child-like” academic status to being a veritable “young adult” in regards to the same.

Notably, Amos was my first doctoral advisor, from ca. 2006 C.E. to ca. 2011 C.E. As is common amongst doctor and pupil relationships, I gained far more from Amos than merely a theological methodology, which will be later appropriated in this dissertation, most of which I probably—due to my mental density and damage—cannot source to him directly. But know this: all that I have done in the ensuing years has its rudiment in him. Although I did not finish my dissertation under him, the influence he has had, and has even now, on me is incalculable.

Without each of you, this project could not have come to completion. *To* each of you I offer something infinitely more than mere thanks. I also offer you my very self, with which you can do what you will. Thanks to each of you for being who you are, for what you have done in my life, as well as for what that means to me.

Contents

Preface: Why I Chose This Topic

A contingentist world, I assert, is that in which we live. In fact, my entire life history is one that substantiates the contingentist outlook as advocated in this dissertation. While this is not meant to be an autobiographical section, allow me nevertheless to mention just a few of these contingent aspects of my own life that have shaped me, and thereby also shaped the viewpoint that I now hold. If these contingent events had not happened in my own life, the result of my life heretofore would have been nothing close to what it is at the present time. I stipulate this, for *contingency marks every area and arena of our lives*. Allow me to count the ways:

If, as a young boy of eight years and 364 days old, I had been left at another person's house to be "baby-sat" on 20 December, 1986 C.E., and not my own biological father's apartment—which was the result of contingent circumstances—I very well could have died in the same drunken crash as my biological father in early-morning, 21 December, 1986 C.E. Moreover, had I not—contingently—chosen to leave my high school in the middle of the day of the third week of our senior year with my childhood friend, William, to travel to Napa Auto Parts store in downtown Hawkinsville, GA, on 6 September, 1995 C.E., I would not have experienced "severe and massive" brain damage as a result of the TBI I sustained in the resulting head-on collision that we were involved in on the return trip from downtown.

Further, had I not because of contingent circumstances (he was my luck-of-the-draw advisor) been enrolled in Prof. Arthur L. Tyson's two-semester sequence of "Introduction to General Biology" beginning the Fall semester of 1996 C.E., I would never have become an "intellectually satisfied atheist" later in 1998–1999 C.E. (note that Tyson himself, was and is, a strong theist, to whom I dedicated my last book, so he was not the cause of my apostasy, but rather the enabling condition of it by teaching me so remarkably about biology, which I then

used in another fashion). For this same reason, neither would I have been an Associate Researcher at Emergent Genetics, Inc. making things that the "god" of my youth did not from 2001 to 2004 C.E., that is, had Arthur not stirred me in the manner in which he did in 1996 to 1997 C.E.

Still further, had I not—contingently—taken a young lady who just happened to visit my third church (in Barnesville, GA) one Sunday in August, 2006 C.E. out to lunch following said service, I would (probably) still be a Methodist-of-some-stripe preacher, in fact still fumbling to become a better "pastor" (as Forrest Gump once quipped, "and that's about all I want to say about that"). Wait, I will say one more thing about that: notably, I did not have a mature man involved as a mentor in my life at this time; that is, I was trying to proverbially "wing it" alone. If I had had the involvement of a mature man in my life at this time, I probably would have seen this "golden-haired woman" for what she was: an emissary of Satan. But that is, truly, a topic for another book.

What's more, had I not answered an email—contingently—about the then-new non-residential PhD program at Regent University in the early months of 2006 C.E., I possibly would have never begun this fascinating journey toward a PhD, and hence never met Dr. Amos Yong. This contingency just expounded upon had other repercussions as well: had I not immersed myself in Process studies generally, and "emergence studies" specifically, while with Amos at Regent, I would never have gone onward to in fact finish a PhD at Claremont School of Theology, under the mentorship of Dr. Philip Clayton. I could go on and on, but I trust my reader has gotten the point: we live in a world marked by contingency, not predetermination, and that *contingency marks every area and arena of our lives*.

So… why did I choose to write this dissertation? Why spend the majority of my life heretofore working (and veritably it has been more than half of my adult life; in fact, it has constituted about 85% of my post-TBI life…) on this dissertation (book)? As many of my acquaintances well know, I was rendered comatose via “severe and massive” brain damage in the year 1995 C.E., and spent the majority of several months in said state. When I awoke, I was mad at everyone: you who are now reading this dissertation, my mother (inordinately so: we hurt the most those whom we love the most, in an uncanny twist of nature…), but most of all at “god.” Or at least, that is, at the caricature with which I had theretofore been imbibed.

Moreover, the distinct possibility of a “loving god” had a particular propensity to tick—better: “piss”—me off. Hell, I thought to myself, why would a “loving god”—a most maximally loving god—“cause” me to go through what I did as a teenager (at 17 years old)? After all, the god of my youth was all-knowing, all-powerful, and hence all-controlling. So then, that “god” not only “allowed” my disfigurement physically (shattered pelvis, etc.) and mentally (traumatic brain injury)—nay, he actually “caused” it. And the more I thought of that, the madder I got (excuse my English, but it makes perfect sense). Insomuch as, my (severely and massively damaged) brain soon began to “boil” with both frustration and anger. Anger abounded. I doused myself—when I finally “freed” myself from the constraints of my parents in 1997 C.E.—in light drugs and heavy alcohol. Indeed, there isn’t much—beyond my actual schooling in college—that I even remember from college.

Admittedly, that last comment might not be too rare of a story, but I had enormous underlying despite—nay, hate—for all things (and people) not named me. Indeed and verily, I stewed in my anger in self-imposed seclusion for virtual alcohol-inundated years. I knew the full thrust and verity of Thoreau’s insight that “the mass of men lead lives of quiet desperation.” I

persisted in this unloving—and unlovable—state for the mass of my undergraduate years. In so doing, I destroyed virtually every single relationship—male or female—that I then had. In fact, I was awash in self-pity, along with a strong dose of self-hatred mixed in. I knew the *telos* of my existence: to do away with that damnable notion of a "loving god."

So then, I pursued biological studies in my undergraduate education. There was an underlying reason(s) for such: not only did it "stretch" my mind cognitively—which I definitely "needed" at that juncture of my life, recovering still from the TBI—but it also had the added "benefit" of undermining that pesky notion of a (and especially "the") "loving god" that I had been reared under. In fact, by the near-end of my biological studies in Fall semester, 1999 C.E., I was living the "High-Life" (this is a veiled reference to the popular beer: Miller) and had "successfully" disproven that damnable "loving god."

Or, so I thought.

In the Spring of 2000 C.E., as most of us adults with any modicum of investing skills well remember, the stock market collapsed. I lost an enormity of money in about three months (especially through the now-defunct ticker symbol CMGI), the amount of which still depresses me, and I quickly thereby became befuddled: my quasi-"god" of the greenback suddenly departed from me. All of my security—along with whatever "pleasure" it bestowed—similarly fled from me.

Or, so I thought.

In the summer months of 2000 C.E., I began my regular "employment" as a cotton scout in the nether regions of the southern Georgia "Cotton Belt"; that is, I immersed myself in the walking of cotton fields, looking for and quantifying insect infestation therein, which was then exterminated by crop-dusting. This "job," which truly I only used for (more) beer money and

other "luxuries," allowed me much time alone—with only myself and I. During my "dry" periods of the day, walking the miles of cotton fields, God—the one I formerly and formally detested—began working on this little boy (emphasis on boy) of twenty-two and-a-half years.

Ultimately, I surrendered to a "God" I barely knew anything about on 24 July, 2000 C.E., in a cotton field about a mile-and-a-half outside of Vienna, Georgia, on the eastern-most side of Highway 27 West, at circa 1:12PM. I remember it well. This meeting with God and I forever reoriented my life, insomuch as over all my travails (and exploits) over the ensuing twenty-one years, I have never fully "lost my bearings," which have been fundamentally oriented toward (and for) God. Indeed, I even preached the Word for a number of years, both in a formal and informal capacity (God bless my first three "pastored" churches; they put-up with a lot of immaturity on my part…).

Concurrently with attempting to preach the Word, I began my initial theological studies that eventually concretized in a Master of Divinity degree from Asbury Theological Seminary. While there at Asbury, I was introduced to the chief "theologian of love" in none other than the indomitable John Wesley. I soon realized that all of my mental "junk" meant nothing at all (see the Third Day song, "Nothing at All") to an all- and ever-pervasive (and persevering) "loving God." Oddly, this recognition was in part due to another Third Day song, "Your Love Oh Lord," which is based on the thirty-sixth Psalm. As I sang repetitively—

Your love, oh Lord
Reaches to the heavens
Your faithfulness stretches to the sky
Your righteousness is like the mighty mountains
Your justice flows like the ocean's tide

I will lift my voice
To worship You, my King
I will find my strength
In the shadow of your wings

—my every problem, it seemed at the time, disappeared. Doing this over and over and over again, the theme of Psalms 36 finally sank in. In fact, I thereafter began to preach the Word with more force than I had theretofore. One might even say that at the end of my preaching years, I actually intimated a worthy and worthwhile "preacher," but still only a growing "pastor" (if that distinction makes sense).

I met many a loving person on my preaching voyages, but none more than the couple named Leion and Nette Smith at my first "depot," who were—at the time (ca. 2003 C.E.)—celebrating their seventy-fifth wedding anniversary! I presided over that reaffirmation of marriage vows: Leion was 94 years old and Nette was 91; however, Leion still doted on her alike to when they were first married. Indeed, although Leion was much worse-off physically than Nette, for example, he would nevertheless "shuffle his feet" (not walk, *per se*) and open every single door for her, amongst other similar things he did for her as well. I thought to myself at that time: if I ever get married, I want that!—whatever "that" is in truth. I have never married, however.

But I can approximate that love, even in my perpetual loner status: I can love others just as they did—until the end (I am ever reminded of our Lord's admonition in Matthew that "he that endureth unto the end shall be saved"). The purpose of mentioning this love given to me by Leion and Nette Smith is not to encroach biblical hermeneutics (for that is not my field of expertise), but only to laud them instead: for they, whatever else one might want state about them, definitely "endured till the end" in love. I want to approximate their display of love in my own life.

I earlier said that I have never been married. And that is entirely true, even though I got really, really close once with the most-excellent female named Jayme Merritt, also from my time at the church in Sycamore, Georgia. Jayme was the world for me for several years, and frankly, in her wake, I have yet to find a woman of comparable standards, beauty, and exquisiteness. So then, in a real sense, I am still living in her wake. Nevertheless, this was my first "real" relationship post my TBI in 1995 C.E., originating in 2003 C.E. I knew nothing of loving rightly (which I use here as both a verb and an adjective), and it ultimately destroyed our relationship in due time.

My, how I wish I could go backward!—I would do many a thing differently with Jayme. Sadly, however, she subsequently passed-away from a major killer of young ladies—cervical cancer—at the young age of ~32 years old (ca. 2009 C.E.). In many ways, although our relationship did not work out, she taught me numerous things about the nature of love, which in a strange twist, actually almost align seamlessly with the content and contentions of Thomas Jay Oord's notion of "full-orbed," uncontrolling love that will be outlined, exposited, and (hopefully) extended in this dissertation. She loved without control. And frankly, I miss her and it.

Fortunately, I have learned in my subsequent education and especially in my own life experience(s) (for if I am a failure at anything, it is consistently loving people and "stuff") that when one "loves," never can they do it perfectly. However, the act of love itself *is* perfect—and perfection itself is thereby embodied in and through the empowerment of the Spirit of the Christ (the definite article is used here intentionally, note). While this is not meant to be a "mushy" theological dissertation, its implications are undeniable. If there is one thing I have learned from my absorption into (and adhesion unto) Thomas Jay Oord's theological reflections on the "full-orbed," uncontrolling love of God, it is that God does not control the responses of his entities to

his overtures of love bestowed. Though it befuddles me, God *kenotically* and amorepotently loves me, and that undeniably and uncontrollingly.

So… I have come full circle: I went through a youthful exuberance of loving God (which I do not remember much of), to then denying that there was even such a thing as God (which I remember too much of…), only to come back around to posit a *kenotically*-donated, amorepotent, "full-orbed," and uncontrollingly loving God. I have come to this position in perhaps the most trying year for us as a nation socially and corporately in decades. As my maternal grandfather—Pampy—would oft state: my, how the world turns.

Notably, I write this Preface on the "day" of my redemption in the cotton field, twenty-one years afterward. Indeed, on this day, twenty-one years ago, I began my "spiritual journey." And what a journey it has been! Notable also is the fact that I just finished a long Zoom meeting discussing this dissertation with Philip Clayton, my soon to be *Doktorvater*. Dr. Clayton has truly been a formative influence upon me these last three years, taking me to heights of my intellect that I knew not were possible, which is clearly perceptible, for example, in placing my first (very poorly written) book—*A Modern Relation of Theology and Science Assisted by Emergence and* Kenosis (2018)—alongside one of my latest books, *Evolution: Secular or Sacred?* (2020a). Clayton's involvement and influence on this latter title of my own is evident in my "tighter" argumentation, and the better overall "flow" inside the book, for example.

Doktorvaters often expect their pupils to build upon, extend, or augment their own work, and thereby extend their own legacies. While Clayton's explicit oeuvre of work does not factor into my own work herein explicitly, in a sense, it is everywhere implicit within this title. Phil, as I affectionately refer to him, has a most-quiet demeanor, but has a reservoir of confidence in his intellect that cannot be dismissed easily. Also, he has a manner of loving people that is

remarkable. Ever-encouraging, even when not deserved, Phil makes me feel comfortable about not only my work, but life in general. As a Quaker (that is, the "Society of Friends"), he lives a life of friendship. A simple life of love, one might say. He exemplifies this notion, and I desire to emulate not only his life of love, but also his theological acumen in my own life. Amen.

Bradford McCall

24 July, 2021 C.E.

* Notably, I am not a crying man, by any means. My TBI has forever mangled the modalities of my mind, insomuch as I laugh at times I should not, do not get angry when I should, and conversely get angry when I should not (less so now than previously, as I have "adjusted" to social norms over the last quarter-century). In fact, I have cried, over the last quarter-century, only the number of times I can quantify with my fingers on one hand. But I cried—no, I wept—constructing this Preface. Perhaps my synapses are relearning the connection to this valuable emotion? Nah, it is just a contingent one-off…

Chapter 1: Introduction

Framing the Question—Toward a Contingentist Model of Divine Involvement (Activity) in an Evolutionary World

I do not think humans are created *imago dei*. Period. I think, instead, that sentient entities—in varying levels—are, however, created *imago dei*. A good biological argument could be made to support the notion that sentience is more fundamental, more linked, to the theological postulation of *imago dei* than merely "humanity" itself. So then, God's *telos* is sentience, but not necessarily humanity. Indeed, nothing—absolutely nothing!—from biology indicates that Homo sapiens *sapiens* are the end (*telos*) of evolution. Instead, we are merely the pinnacle (in process, mind you) of (macro-)evolution heretofore. What the next "stage" of (macro-)evolution might hold for sentience is hard to project, and in fact I have not the capabilities to do such. The point remains, however, that Homo species are not the "end" of evolution as we know it—the process continues, and only our lucky stars, for whom we should give much thanks, know what the next stage(s) of sentient thought may be.

Neither supernaturalism nor physicalism are viable options for me, as a theologian from below (see Pannenberg 1968), hence doing bottom-up theology (see Polkinghorne 1994a) in the (late-)modern world. Some scholars may choose to use the term post-modern, rather than (late-)modern. However, I will consistently employ the term (late-)modern because I maintain that the contemporary era still maintains some modern presuppositions that pose challenges for fully using post-modern language.

My thesis is simple. I propose that my panentheistic theology from below methodology provides a plausible philosophical and scientific framework for a viable constructive theology of

the *imago dei*. Such a panentheistic theology from below approach also presents resources for considering divine involvement, or what has traditionally been called divine "action," beyond reductionist anthropological models or traditional supernaturalistic options. The theology from below proffered in this book will be informed by an interdisciplinary framework that accounts for historical evolutionary biological perspectives (primarily through Darwin), and engages constructively with contemporary evolutionary biological research (through Gould, Ruse, and Conway Morris). This theology from below will then be informed by Charles Sanders Peirce's "evolutionary developmental teleology," as I term it, which involves an original view of causation in that each act of it involves an efficient component, a final component, and a chance component. The argument will unfold toward and climax with a theological appropriation based on the theology of "full-orbed," uncontrolling love, as presented by Thomas Jay Oord.

Evolutionary biology is the *sine quo non* ultimate explanation for all of reality in the contemporary context. In order to gain traction within the Academy (at large) today and to demonstrate that biology itself matters, then, this dissertation will have an extended (deep) dialogue with evolutionary biology. I will note from the onset that I am deeply invested in the principles of biology, particularly (macro-)evolution. I believe fully that (macro-)evolution is the best account of the advancement of species on tap today. In fact, my own position lies closer to that of Stephen Jay Gould than to most theologians. Indeed, coopting the well-known words of the great formalist William Bateson, "my brain boils with evolution." My intellectual debt and psychological fealty to Darwin can only be called pervasive.

But I am also religious—in fact, I am a Methodico-Catholic, one might say (having been influenced by Methodism and Catholicism). I am no apologist for religion. But again, I am religious, an assertion that generates at least the following set of questions: why would a religious person care if there is traction between the evolutionary sciences (biology) and divine involvement (or activity), or even religion for that matter? Is not religion (theology) a different language game than evolutionary biology (science) (see Wittgenstein)? Emphatically, I state, in no wise is that the case. In this dissertation, I—in part—propound and establish why this extended "case study" that seeks to develop traction between evolutionary biology and theological divine involvement through "full-orbed," uncontrolling, and "amorepotent"[1] love is vital—nay, essential. I am herein coining the term "amorepotent" as a portmanteau of the Latin term "amor," which refers to a love affair, and the English term "potent," in order to refer to God's enormous amorously potent empowering love.

I prefer the terminology of divine "involvement" or "activity" over and above divine "action," in part because "action" seemingly connotes specific instances, whereas "involvement" and "activity" refer to actions done over the course of time, or even one's life (if I may use such a reference for God). So then, I am avoiding "action" language because "action" refers to particular instances of various exploits, whereas "involvement" and "activity" are more nebulous in their referents. Defined as such, I argue, "divine action" is a losing game for theists, for each

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[1] I am using a portmanteau because the Latin base for "potent" does not exactly form a coherent word in modern English. Indeed, the Middle English "*potent"* is borrowed from Latin *potens*, *potentis* ("powerful, strong, potent"). I simply do not like the sound of "amorepotens" or "amorepotentis," and thus have decided to create the above portmanteau.

time we theists propose a specific “causal joint,” one, three, or five years later, science closes it, leaving us worse off for the wise.

This is indeed a critical topic—I aver—and one that is intrinsically related to the applicability and plausibility of theology in the twenty-first century, especially with respect to a theological view of divine involvement—or activity—through amorepotent love. Indeed, evolutionary biology, for all intents and purposes, is one of—if not *the*—major obstacles to a faith-based worldview in the contemporary world. This is because evolutionary biology has assumed the definitive position of explanation *in* the world of today *for* the world of today. No longer are all things seen through the “eyes” (or context) of faith; rather, atheistic viewpoints predominate in the Academy (at large) of the contemporary context, which of course, has a trickle-down effect.

So then, it is incumbent upon faith-endowed academics to bridge the proverbial gap between evolutionary biology (science) and a theology of divine involvement based on amorepotent love in the contemporary environ. However, this is not a work of Christian apologetics as the term is popularly defined. Biology is not a demon to be defeated. Instead, I stipulate, following John Haught, that one of the principal needs for today’s intellectual environment is learning how to “read” the sciences of evolution. The manner in which we “read” evolution determines, to a large degree, how we respond to the onslaught of practitioners who are “against” faith in any sort of context outside the Church.

Herein, indeed, I address how divine, amorepotent love works *with* and *within* a contingentist[2] (i.e., radically contingent) evolutionary theory and worldview. Within the course of this project, I reach a *via media* between the (somewhat) radical formalist position of Simon Conway Morris and the veritably radical contingent position of Stephen Jay Gould. Thereby, I will address such questions as, How is the amorepotent and uncontrolling love of God understood as purposeful? How do I differentiate between purposiveness and simply random outcomes? What is the connection between openness/novelty and the concept of order? And, Is there a differentiation between the amorepotent, uncontrolling love of God and contingency?

The aforementioned questions all lead to the question, What are the things that God values in the creative process? That is, What is it that God is aiming for? Admittedly, my biological training and previous practical experience in the biological sciences provokes within me a more sympathetic final resolution that lands nearer to Gould than Conway Morris. While Conway Morris is more or less a structuralist (or Neoplatonist), I take a more functionalist (or Aristotelian) stance toward these questions. But this admission still leaves open the questions: How does one define God's activity in such a world? How is God's involvement different from a contingent—or what I label, a contingentist—instance? Why do we need a God-idea at all?

In the course of this project, I coopt and adopt (most of) Gould's contentions and thereafter "massage" them into a position that is more congenial to faith in the twenty-first century context. I will argue in detail that there could be and in fact *is* some sort of purposiveness

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[2] I am herein coining the term "contingentist" to refer to both one who emphasizes radical contingency in his or her personal philosophy of *bios* (life), as well as to refer to the instantiation of that very radical contingency in the natural world.

that is nevertheless working in a chastened Gouldian position, such as the one that I adopt and advocate. In so doing, I will delineate how one may distinguish between contingency and veritable divine involvement. I largely follow Oord, who notes that God does not insist upon a particular outcome, but God merely allows propensities to work themselves out. God amorepotently, to use my language, loves the population of the natural world into greater forms of complexity, relationality, and beauty in varied and multifarious forms, along with the extension of diversity. Notably, I am not using the term “loves” here as a statement of fact, but rather in a verbal sense.

I contend that God populates the world through the filling-in of niches, although these niches do *not* preexist the organism, *per se*. Instead, they are “built” within and by the evolutionary process itself. These niches, then, could be seen to be the purposes of God, as proleptically[3] present in the world through the processes of (macro-)evolution. Indeed, the organisms grow into these niches concurrently with the development of the niches themselves, thereby giving rise to much diversity and multiplicity. I aver that the production and generation of complexity, relationality, and beauty in varied and multifarious forms, along with the extension of diversity and increases of multiplicity—themselves—please God and thereby his “intentions” for the natural world are fulfilled.

[3] The term “proleptically,” which I did not coin, is a derivation of the Latin word, *prolēpsis*, which is also in turn derived from the similar Greek term, *prólēpsis*, which refers to assignment of some “thing,” whether that be an entity or activity, to a period of time that actually precedes it. This, then, could—and often is—be used to refer to a pre-theoretical notion that leads later to true knowledge of the world. For example, the stock markets’ crashes of 1930 C.E. and 2000 C.E. were proleptically present in the extreme excesses of the stock markets’ advances in 1929 C.E. and 1999 C.E., respectively.

So, what are these “intentions” of God? I assert that these “intentions” are God’s eschatological goals for the natural world, which are summarily reached through the intensification of sentience. As eschatological goals, these “intentions” lure the natural world, in effect, toward God. “Intentions” may, in a very loose sense, refer to what is otherwise known as “*telos*.” I follow Charles Sanders Peirce (who will appear in chapter five) in this regard, who stipulates that God’s *telos* is ever-growing, not static, and in fact evolves through time, dependent upon the response(s) of his entities. So then, in “creative-responsive” love (à la Cobb and Griffin 1976), God adjusts these “goals” based upon the response(s) of the entities that derive, ultimately, from Godself. That is, God is not a loner-type Monarch, uninvolved totally with the world that he in some sense instantiated. Instead, God works with what is “created” (or better: “derived”) to yet create further things from the original bestowal of agency to the natural world. In fact, God himself promotes and enables a fully reciprocal relationship between his “creation” and himself, through intermediaries of the Son and the Spirit.

In what follows, I attempt to make a good-faith effort at demonstrating the above assertions. Indeed, what then does the contingentist model of divine involvement in the present milieu—that which I develop herein—contribute to the relationship between evolutionary biology (science) and a theology of divine involvement (activity)? Let us proceed in order to break, unfold, and reveal.

Statement of the Problem: Divine Involvement in an Evolutionary World

Confidence in cosmic predictability led the French physicist Pierre-Simon de Laplace to assert, a century after Isaac Newton, that a sufficiently informed intelligence could forecast

everything that is going to happen in the whole universe and—working backwards—tell you everything that did happen. But the (late-)modern understanding of the nature of near universal complexity shatters this dream. And history also includes too much contingency—that is, the shaping of present results by long chains of unpredictable antecedent states rather than by immediate determination—for such a position to be palatable. Notably, the thirteenth-century Christian philosopher Thomas Aquinas insisted that a perfect universe must contain at least a measure of randomness and chance to allow humans their autonomy. I affirm such a contention.

In this project, I argue that both ontological randomness and chance are genuine. God, the ultimate reality, does not determine the outcome of every scientifically random event, but instead constrains randomness by setting broad boundaries, such as the range of possible outcomes of a random event and the probability of each outcome. God then allows particles, systems, and entities to interact according to natural laws within these expansive boundaries, producing a wide range of beautiful and multiplicities of complex results. So then, we live in a world of chance and randomness (see chapter 2 for an amplification of this position). This project looks at how, through paleontological examination, chance and randomness shape the world from the bottom-up.

But how much is truly chancy and random? The phenomena known as convergence, which this project also explicates (see chapter 4), indicates that though evolution through natural selection may proceed along various paths, the destinations are few. So then, there is a dichotomy: randomness and chance are constrained within pattern. I contend that God bestows these constraints at the derivation of the natural world in its current form (i.e., at the Big Bang).

In order to understand the events and generalities of life's pathway, we must look beyond rudimentary principles of evolutionary theory to a paleontological examination of the contingent pattern of life's history on our planet—the single actualized version among millions (if not more) of plausible alternatives that did not occur. Such a view of the history of life is highly contrary to both the conventional deterministic models of Western science and to the deepest social traditions of Western culture which argue for a history culminating in, particularly, "humans" as life's most magnificent expression. In his *magnum opus*, titled *The Structure of Evolutionary Theory* (2002), Gould emphasizes the importance of recognizing both the reality of structural constraint and the notion that structures have "historical," that is contingent, origins. He essentially douses one heavily in functional adaptationist views and historical contingency, while providing strokes of formalism.

In point of fact, Charles Darwin helps unite insights from both sides of the age-old debate between functionalist and formalist biologists. The functionalists—such as Jean-Baptiste Lamarck and Darwin himself—typically stressed that features of organisms exist(ed) for utilitarian reasons (they were adaptations to their environments), and formalists—such as Étienne Geoffroy Saint-Hilaire (1818) and Johann Wolfgang von Goethe (1790)—stressed the structural unity of type common across similar organisms. A formalist often denied the possibility of evolution because they believed that only superficial change, not fundamental change, was possible. This division between functionalist and formalist biologists was permanently undermined when Darwin showed that structures had evolved through natural selection, although

after their emergence, these structures may indeed be constrained by, and in fact further constrain, the evolutionary pathways available to organisms.

In this, Darwin fundamentally reoriented the functionalist-formalist debate by adding a new dimension to the functional (active adaptation) and formal (constraints of structure) dichotomy: historical contingencies. Life's pathway certainly includes many features predictable from the laws of nature, but these aspects are far too broad and general to explain evolution's particular results—cats, dogs, mushrooms, humans and so forth. Indeed, organisms adapt to, and are constrained by, physical principles. It is, for example, scarcely surprising, given the universal laws of gravity, that the largest vertebrates in the sea—whales—exceed the heaviest animals on land—elephants.

Three features of the paleontological record stand out in opposition to the conventional view of the history of life as a broadly predictable process of gradually advancing complexity through time: first, the constancy of modal complexity, which I here use to refer to the number or value that appears most often in a particular data set (e.g., there have been interest rates of 0%, 2.5%, 4%, and 10% in the last several decades, of which the modal value of the last thirty years-plus is approximately 4%); second, the concentration of major events in short bursts interspersed with long periods of stasis (or stability); and third, the role of external impositions from outside of the Earth's atmosphere or orbit—primarily mass extinctions caused by meteorite impacts—in disrupting patterns of "normal" times. These three features of the record, combined with the more general themes of chaos and contingency, require a rethinking of the oft-accepted framework—gradualism—for conceptualizing the history of life on earth.

So then, the problem to be addressed in this project concerns developing a plausible hypothesis of divine involvement (activity) in an evolving world for (late-)modern theology. In fleshing this problem out, I stipulate the vacuity of three different broad conceptions of divine involvement in the world today: first, the incongruity of incompatibilist divine activity; second, the hyper-intrusiveness of particular micro-level divine activity; and third, the impracticality of general deistic divine lure and influence. Many questions are raised in considering the relationship between an entity's free actions and the independent causal processes described by the natural sciences; notably, this debate is almost exclusively a product of the modern era. As such, questions focusing on the relationship between an entity's freedom and determinism have been at the forefront of philosophy for the last three-hundred years, and the contemporary debate about divine activity and science owes a large debt to this history of involvement betwixt the two.

Incongruity of Incompatibilist Divine Activity

One of the most un-useful of distinctions in this involvement between divine activity and science is that betwixt compatibilist and incompatibilist approaches to an entity's activity. Thomas Hobbes, writing in the seventeenth-century, is widely considered to be the first to adopt a distinctly compatibilist position. Hobbes' argument was essentially that determinism and freedom can be logically consistent—or, that is, that we entities in the natural world can exist in a totally deterministic physical world, and yet remain individually marked by free-will. This position has had dominant sway in the majority of history.

Compatibilism, purportedly, offers a solution to the historically important free-will problem. The free-will problem concerns a disputed incompatibility between free-will and determinism. Compatibilism is the thesis, then, that free-will is “compatible” with an entirely deterministic framework in regards to the natural world. Freedom is nothing more than an entity’s ability to do what it (he, she, etc.) wishes to do in the absence of impediments that would otherwise stand in its way. Compelled action arises when an entity is forced by some external influence to act contrary to that entity’s free-will. Compatibilism, then, emerges as a response to causal determinism.

Ted Honderich 1993, 100–102), in the late-twentieth century, identifies the following similarities between various compatibilist positions: first, they agree that the idea of initiating free choices is inherent in our language of activity; and second, that compatibilists argue in force that the idea of free-will is a choice that is according to the “desires of the chooser.” Where incompatibilists, largely, differ is that they assert not only must a free choice be in accordance with the entity’s desires, but also that the entity is capable of being morally responsible iff the free choice is not only voluntary, but also causally originated—that is, only if determinism does not hold, the incompatibilists argue, can there be entity-originated choices (free-will) with regard to its activities.

Incompatibilists assert that when an entity acts of its own free-will, he or she or it, could have acted otherwise. The determinism mentioned in the above paragraph informs us that, given the facts of the past and the laws of nature, only one future is possible, much less plausible. However, according to the conception of incompatibilism, a free-willing agential entity could

have acted other than the entity actually did and, hence—*ipso facto*—that more than one future state is possible, if not also plausible. According to the incompatibilists, if determinism is true, then no entity has access to alternatives of the sort that are required for free-will.

Why do I label incompatibilist divine activity as incongruous? For one thing, I consider incompatibalist divine activity to be virtually, if not totally, nonsensical. So then, with reference to God's involvement, which is the particular foci of this book, this categorization can be made in analogy with the free-will debate by emphasizing the role of the origination of causal processes, insomuch as compatibilist instances of divine involvement are the activities of God which may be accommodated into and by the existing causal sequences of nature without God initiating a particular causal sequence that otherwise did not exist without his involvement. Incompatibilist involvement, on the contrary, are those activities of God that are instantiated through and by the initiation of new—by which I mean different and direct—causal sequences in the natural world. This is a position that I vehemently reject, and that outright. What this rejection of my own implicates for the traditional notion of miracles should be obvious to all of my (patient) readers—pointedly, I do not think such things are even remotely possible, and are downright implausible. More about this later, however, in a different book.

Hyper-Intrusive Particular Micro-Level Divine Activity

Further, why do I contend that particular micro-level divine activity is hyper-intrusive? First, allow me to describe what I am referring to by this moniker: as I see it, micro-level divine activity is nothing more than what is commonly referred to divine activity at the quantum level. William Pollard's book, *Chance and Providence: God's Action in a World Governed by*

Scientific Law (1958), seemingly got the contemporary bandwagon rolling about this putative manner of God involving himself in the natural world; indeed, he truly set the standard for contemporary debates about quantum divine involvement. While quantum theory is (most) often viewed to be consonant with divine involvement, or even "special" divine activities, I argue instead that divine activity through micro-level quantum events is truly hyper-intrusive.

Pointedly, this is because if God were to use this micro-level methodology of involving himself in the natural world, it would amount to a constant micro-managing of every minute detail within the causal nexus of the natural world. This would mean, for example, that God not only merely "influenced" the position of one quantum event, but that God—instead—would have to influence every quantum event in an unknown-quantity of actual events in order to get his intentioned result. This would not just result in merely one "influential" movement of a quark, then, but a constant manipulation of quarks in an endless series. Talk about hyper-activity! This would, in the end result, be nothing more than a form of causal determinism, too—for God would have his finger on every quantum event, which is, frankly, absurd. This is, indeed, a slippery concept, for it leads logically to a position that adherents to this methodology of God's involvement want to avoid: that is, a strict causal determinism, at least in my opinion.

In his personal letter to Eberhard Bethge on 29 May, 1944 C.E., the great theist Dietrich Bonhoeffer sums up the problem(s) of this micro-level quantum activity by God excellently. I would like to quote Bonhoeffer extensively; he writes:

> [C. F. von] Weizsäcker's book *The World-View of Physics* [1952] is still keeping me very busy. It has again brought home to me quite clearly how wrong it is to use God as a stop-

> gap for the incompleteness of our knowledge. If in fact the frontiers of knowledge are being pushed further and further back (and that is bound to be the case), then God is being pushed back with them, and is therefore continually in retreat. We are to find God in what we know, not in what we don't know; God wants us to realize his presence, not in unsolved problems but in those that are solved (Bonhoeffer 1971, 311).

It seems to me that the point Bonhoeffer was making is that having God as a "stop-gap" to plug holes in human knowledge is a risky strategy because the holes might be plugged by other means later. And, in fact, has not the history of science born this to be true time-after-time? This is, of course, but one reason why I do not advocate "divine action" language, as I have previously established in this introduction—the holes always, always, get filled, which leaves theists worse off than before. This is also a good testament to why I do not indicate a "causal joint" in my hypotheses, for they—too—always get knocked down by the persistent march of scientific knowledge.

Impractical General Deistic Providential Divine Activity

And still yet further, why do I assert that general deistic divine lure and influence is impractical? I stipulate this assertion regarding general deistic divine activity, mostly anyway, because deism is inherently untrace-able, meaning that it is sort of like a "hands-off" construction of a majestic painting. It simply is not possible or plausible. If those who aver a deistic-like framework for divine activity were truly honest to themselves, in my opinion, they would simply leave this entire discussion of "divine activity" un-broached altogether. Maurice Wiles is someone who I particularly put into this camp.

Wiles states the case plainly in 1981 (248–49): the various lines of argumentation for God's agency, as historically posited, have "only served to strengthen my conviction that the process of trying to make sense of the biblical witness and of the experience of grace may well involve substantial modification of the concept of divine agency or even its replacement by some other conceptuality altogether." In his fight against what may be termed "special divine action," Wiles (1986) advocates instead what may be termed "general divine action," or what I refer to above as "general deistic divine lure and influence." Not only do I see such double-speak as problematic, but more so do others who work in this field. For example, Brian Hebblethwaite (1982, 187) titled his book review of Wiles' work "God's Inaction in the World." Malcolm Jeeves and R. J. Berry, other late-twentieth century participants in this discussion, but from a broadly "creationist" perspective, claim that Wiles advocates a "sit back and watch" God (Jeeves and Berry 1998, 110). Also, the ever-perceptive John Polkinghorne (1998, 86), who claims to be a "bottom-up thinker" (1994a, 1994b), but whom I do not truly see as such, rejects Wiles' work on the basis that Wiles' "atemporal deism… is hard to reconcile with religious experiences of prayer and of the prophetic discernment of a divine special providence at work in history."

Having dismissed forthrightly these three vague and yet "popular" alternatives, and moving now into my own constructive argument for divine involvement in an evolutionary world, I begin with an admission of contingency being everywhere enormously exhibited within the natural biological world. Understanding the pervasive character of contingency in our present milieu, how might God's "goals" for the natural biological world be realized? This problem can be understood and approached from numerous perspectival angles within evolutionary theory,

broadly understood, five in particular of which I will employ. First, I will expound upon the radical evolutionary contingency hypothesis—arrived at through struggles with the notion of "progress"—as advocated by the eminent deceased philosopher of biology, Stephen Jay Gould.

Second, I explore a distinctively Darwinian understanding of "progress" in (macro-)evolution through the lens of Michael Ruse's philosophy of biology, which in part shows that even as much as Gould (and truly Darwin himself too) disputes the notion of "progress," a refined and redefined notion of "progress" is ever-present in the evolutionary epic (or play).[4] Third, the evolutionary convergence thesis as set forth by structuralist Simon Conway Morris is examined that asserts the practical duplicability of our present results in any possible world, insomuch as no matter how many times one might re-run the tape of evolution, most occurrences (and entities) would turn out (nearly) the same as in our present dispensation. That is, it would forever be a "progressional" rise from monad to man.

Fourth, I discuss the contributions of the American polymath, Charles Sanders Peirce, which builds a point of view that is fundamentally oriented to and by the future, influenced as it is, by his "evolutionary developmental teleology," as I term it. And finally, I work with Wesleyan-relational/Process scholar, Thomas Jay Oord, whose notion of the "full-orbed" and uncontrolling love of God will be amalgamated into my constructive amorepotent, panentheistic contingentist theology of divine involvement in an evolutionary world, principally with respect to the active and reactive (succinctly, "creative") Spirit of God, so there will be potent linkage to pneumatology (see McCall 2019c, 337–50).

[4] Note that I am here employing the term "epic" to refer to a meandering story, one that has multiple twists and turns, but not as a story that has its ending predetermined from the outset.

I argue herein that God through the Spirit is both the immanent and eminent principle of creativity, ever empowering and wooing forever forward the advancements in and of complexity within biological evolution toward increasing expression of sentience (that is, what I refer to as the traditional concept of *imago dei*). I contend herein also that God, particularly in and through the activity of the Spirit of creativity, was fully present *in* and *with* and *under* the natural world from the very beginning of our current dispensation (the Big Bang)—and will be to the end of time (the *eschaton*), proleptically present as the expression of the principle of creativity.

I maintain that the Spirit, by God's *kenosis* of her into the natural world, imbibed herself *into* nature, which led to an evolving fertility that has continually manifested itself, in short, in and through the increases of complexity and the intensifications of sentience in the natural environ. This primal imbibition or imbibification by God of the Spirit into the world of nature instantiated within the natural world an *activation* of the naturally occurring, inherent potentialities within it, thereby producing a distinctive *self*-creativity within the world. Somewhat akin to Charles Sanders Peirce, who famously said that we need a "thorough-going evolutionism or none," I contend that we need a "thoroughly *immanent* God or none," (or at least as close to as is possible), all the while noting that both *immanent*- and *self*-creativity are marks of this overall poietic (productive, i.e.) process known as biotic evolution.

Thesis and Anticipated Conclusions

Divine Involvement through Creative Interplay of Contingency and Law

This efficacious divine activity through the Spirit is termed, herein, as "*kenotically*-donated, self-giving divine involvement through amorepotent and uncontrolling, contingentist

emergence and punctuated equilibrium." Unpacking such, I stipulate that there is divine involvement through a creative intersection of contingency and law, amounting to contingentist divine activity *via* a heavily modified notion of structural forms, which is pneumatically (i.e., "Spirit") derived. Additionally, I stipulate that divine involvement is evident through realizations of punctuated equilibrium, meaning that there is contingentist divine activity *through* punctuations, which is further pneumatically derived. Thirdly, I stipulate that there is divine involvement through instantiations of amorepotent, uncontrolling *kenosis*, which amounts to contingentist divine activity *by* self-giving love, which further is also pneumatically derived.

So then, there is definite kenotic creativity through cosmological causes, which is a direct result of God's *kenosis* of the Spirit *into* the natural world, which also amounts to (a sort of) Spirit-derived causation through her mutual immanence and contiguity with the natural world. I contend this mutual relation is constituted, succinctly, by the amorepotent, *kenotically*-donated Spirit. Thereafter, endowed and empowered by the Spirit of creativity, there is a creative advance into the future that is both entity-created and entity-directed, even though God may lay out some general "goals" that lure the natural world forward in complexity, relationality, and beauty in varied and multifarious forms, along with the extension of diversity and increases of multiplicity. All of the preceding affirms that evolutionary pathways reside within the parameters of God's amorepotent, uncontrollingly loving intentions. Allow me a moment to write of my conception of amorepotent, "full-orbed," uncontrolling love a bit more.

I argue in this dissertation for a notion of love that is necessarily *kenotically*-donated, self-giving, self-donating, creative, amorepotent, and uncontrolling. In so doing, I use several of

my own and several of Thomas Jay Oord's texts as my launching point, and aim at substantiating that this necessary, *kenotically*-donated, self-giving, creative, amorepotent, and uncontrolling love is empowering of the "other" and allows for the interactivity of matter and the godhead, since it is principally pneumatologically derived and established by an imbibification[5] of matter with the Spirit of God. Some of these terms are Oord's, while some are my own; the distinction will become apparent in the pages that follow.

I will note, however, that I did not originate the terminology of love as self-donation, which is a principle upon which my "full-orbed," amorepotent, "*kenotically*-donated love" is based (Karol Wojtyla did; cf. McCall 2017e, 21–32). Neither did I originate the terminology of "full-orbed" or "uncontrolling love" (Oord did, as will become apparent in later chapters in this dissertation). But it should be noted that Wojtyla's self-donating love is a strong correlate to Oord's characterization of full-orbed, uncontrolling love. Accordingly, I will employ both terms—or at least their application—in what I have come to refer to as "*kenotically*-donated love." This depiction of my own is based fundamentally upon the notion that *kenosis* amounts to self-giving with reckless abandonment. Whereas I originated neither of the two aforementioned terms, I think (at least to the best of my knowledge), however, that I did originate the usage of the term *kenosis* as a self-offering (McCall 2008).

As a result, Oord and I have both been picturing *kenosis* as essentially self-giving (i.e., as an "infilling" [McCall 2008], a "self-offering" or even a "self-donation" to the *other* [McCall 2017e]) since or about the year 2008 C.E. Self-donating and self-giving love are both

[5] I have coined the term "imbibification" to refer to the process by which some entity, something, or someone is imbibed by the Spirit of God.

manifestations of God's love *to* his creatures, *for* his creatures, and *through* his creatures. In what follows, I use the terms self-donating love and self-giving love *to* and *for* the natural world as highly illustrative, essentially equivalent metaphors with which to picture the creative Spirit's dynamic presence within the world throughout history through *kenotical* donation. The dynamic presence of the Spirit in the natural world is demonstrable (as the net result) by the ever-increasing levels of complexity, relationality, and beauty in varied and multifarious forms, along with the extension of diversity, but most of all, through the intensifications of sentience derived through (macro-)evolution.

Kenotically-Donated, Self-Giving Divine Involvement through Uncontrolling, Amorepotent Contingentist Emergence ***and*** *Punctuated Equilibrium*

I postulate that the most cogent manner in which to picture and perceive divine involvement within the natural world is, succinctly, through the lens of a *kenotically*-donated, self-giving, amorepotent panentheistic contingentist emergentism (see Philip Clayton's extensive oeuvre, especially Clayton 2018; see also McCall 2009; Bradnick and McCall 2018), brought about by, in, and through instances of punctuated equilibrium (cf. Gould, chapter 2). Allow me to unpack that sentence a little more. I will be championing an idea regarding divine involvement in the natural world through a mutual meeting of contingency and law, as depicted in the "functionalist" versus "structuralist" debate in evolutionary biology (see Gould and Conway Morris for this point in chapters 2 and 4, respectively). This will amount to, in other words, panentheistic contingentist divine involvement in part through (a heavily altered conception of)

structuralist forms. These “forms” emerge naturally through the evolution of physical principles, though one could say also that they are “intended” by God.

Second, I deem it true that this divine involvement is enacted through instantiations of the paleo-biological phenomena known as punctuated equilibrium (cf. Gould, chapter 2), insomuch as divine involvement is to be perceived as constituted by punctuations—which in fact is the Spirit’s veritable activity—as evident in the fossil record, versus a continual and gradual evolution of all things (i.e., the strict Darwinian view). However, I will note immediately that in my depiction of divine involvement, since it is necessarily future-oriented and constituted by a “lure” instead of an “act,” there is no “causal joint” to seek after: such a pursuit of a causal joint is rendered innocuous by the method of involvement that I postulate herein.

Divine Involvement through Instantiations of Uncontrolling Kenosis

A third anticipated conclusion concerns divine involvement being constituted, fundamentally, by instantiations of uncontrolling *kenosis* with respect to the imbibified Spirit. The term “imbibified” is a term coined by myself to refer, as one may surmise, to the result of the imbibification of the Spirit of God into matter, which makes matter *matter*. Notably, I have derived this conjugation of “imbibification” from English principles regarding suffixes. Indeed, I have derived this term from the addition of the English suffix “ation” to the verb “imbibe,” via another suffix, “fy.” The English suffix, “fy,” is a verbal one meaning “to make,” “cause to be,” “render,” “to become,” “be made.” The suffix was introduced into English through coopted words from Old French (e.g., deify, deified, deification), but is also commonly used in the formation of new words, usually on a Latin root (e.g., reify, reified, reification).

By adding the suffix "ation" to the end of the verb "imbibe" via the suffix "fy," I am effectively making it into a noun that has reference to an activity (i.e., a verbal noun); and while suffixes often change the meaning of the term from its original intent, I intend this newly coined term in the original sense of "imbibe" itself: that is, "soaking into," "absorption," or "assimilation." So then, the term "imbibification" refers to God's primal imbibing of Spirit *into* matter at the origination of the world formation from undifferentiated matter, which causes the Spirit to be embedded within nature, and thereby be embodied within it as well. I am here extending my usage of the term imbibification from a previous publication (see McCall 2017a), the process of which onsets an evolving fertility within the natural world as well as the panentheistic orientation of God and the natural world. Indeed, I previously argued for the concept of imbibification in stating that it refers to the process by which the Spirit once imbibed (in the Latin sense of *imbibere*) the natural world with herself, and now continues to imbibe the world with her very being, by which the advancement of species toward intensifications of sentience is made possible, educed, evoked, and effected.

The panentheistic relationship between God and the natural world was initially wrought by the *kenotical*-donation of God's very self *into* chaotic matter eons ago through the descent of the Spirit into matter, and is now continually sustained and upheld by God's repetitive imbibification of the creating Spirit—that is, the impartation of her very self—into the natural world. Indeed, the term imbibification is a word that refers to the descent of the Spirit into matter, enacted by God, which causes the Spirit to be both embedded and embodied within nature (for a fuller treatment of this postulation, see McCall 2019b; also see McCall 2020a,

chapter 7). This term imbibification, then, refers to the process by which some entity—something or someone—is imbibed *by* and thereby imbibified *with* the Spirit of God. Notably, in botany the terms "imbibe/imbibition" are used interchangeably with reference to a seed imbibing water from the ground, which is a cooperative event betwixt the receiving seed, and the water that is present in the immediate environment to the seed.

Imbibition, indeed, is the uptake of water by a dry seed, which involves absorption of water by the cell wall and protoplasmic macromolecules. Imbibition, in plant seeds, is also essential for enzyme activation, breakdown of starch into sugars, and transport of nutrients to the developing embryo. Thereafter, given the right environmental conditions (this is a key point), the seed expands and "germinates." This is the sense in which I am using "imbibe" in this project, not in the sense of drinking something, which is the "normal" definition, but in the sense of a seed imbibing H2O—there is a definite "soaking" of water *into* the seed. It is a truly cooperative event between matter (the seed) and water.

Notably, the English term imbibe itself is derived from a French root (*imbiber*/*embiber*), meaning to "soak into," which in turn is directly related to the Latin *imbibere*, which means to "absorb." Notable also is that in middle English, the word "imbibe" directly had the sense of absorb, or cause to absorb, or even to take into solution. Again, this "soaking into" is what I intend to connote by the term "imbibification" that is employed throughout this book. Thereafter, imbibified with the Spirit of contingency within evolution, the natural world progressed in a serpentine manner into the advancement of greater complexity, relationality, and beauty in varied and multifarious forms, along with the extension of diversity, and thereby ultimately of

intensifications of sentience, of which Homo sapiens *sapiens* are the pinnacle (at present, anyway). By invoking the terminology of *kenosis* in this third anticipated conclusion, I intend to highlight the inherent self-giving (or self-offering), other-centered, and other-empowering love lavishly bestowed upon the natural environment by God's *kenosis* of the Spirit into the natural world (see McCall 2008 and McCall 2018, along with Oord's numerous texts to be referenced later for this point). The first six chapters of this dissertation are used in order to lay the groundwork for fashioning this multidisciplinary (science, philosophy, and theology) project, which culminates in my own constructive theological argument, the movements of which were sketched out above. I suggest four implications (and one putative implication/statement)—based on an analysis of Gould's contentions regarding radical contingency, Ruse's view(s) of biological "progress," Conway Morris's structuralist revisions to Neo-Darwinian theory, and Peirce's "evolutionary developmental teleology," in conjunction with Oord's "full-orbed," uncontrolling love—in relation to what this literature means for those of us who insist on the existence of a God inescapably marked by relational, amorepotent love.

Four Implicated Suggestions (and One Putative Implication/Statement)

First, contingency (often times equate-able with the notion of "randomness," but this is not a one-for-one exchange of terms, I contend) in nature is genuine (cf. Gould, chapter 2). God coopts and thereby employs this contingency and randomness in order to maximize the population (filling-out) of the natural world through dynamic and complex systems and thereby instantiate the derivation of sentience, which is slowly thereafter worked-out cooperatively with entities in the processes of (macro-)evolution. Second, however, this genuine contingency does

not exclude the expression of similar form—sometimes even the expression of the same rudimentary sentience!—among widely disparate evolutionary lines. These findings of the expression of similar form, even among and within widely disparate evolutionary lines, strengthen the case that mechanical optimization can drive (macro-)evolution, as noted by the bio-philosophical construct of convergence theory (see Conway Morris, chapter 4). Even considering elementary forms of life, the pattern of convergence dominates, suggesting that there is a God of (some sort of) purpose behind it all, wooing and luring and behooving, if you will, the natural world forward in complexity and diversity toward the eschatological goal of communion with Godself.

Third, Ruse's insights into biological "progress" gives one just as much ammunition to affirm it as to deny it; so then, the advocation or denial of biological "progress," is, at the end of my readings and writings, a matter of "personal preference" in that it is plausible in this instance to "argue out of both sides of your mouth," so to speak (see Ruse 1996, chapter 3). Fourth, Peirce's contribution to this endeavor is to give a metaphysical basis for the ever-evolving, and therefore always growing, *telos* toward which the natural world is heading inevitably and irrevocably, that is, union with Godself (see chapter 5). So then, in a sense, in a possible fifth implication/ statement, this project also affirms the deification of all things, the reprobate as much as the "saint." Does not Scripture instruct us that at the *eschaton* God will be all in all (see First Corinthians 15)? I will not expand on this fifth putative implication or statement in this dissertation beyond what is said here (I must leave something for another book, after all).

Theological Methodology

The methodology employed in this project of constructing an amorepotent panentheistic contingentist account of (macro-)evolution for (late-)modern theology is composed of six movements within a quaternity of positions: first, a broad introduction in which the problem is stated and both the thesis of the project and its anticipated conclusions are given; second, a re-reading of the contingentist Darwinian trajectory within (macro-)evolutionary biology through an assessment of the writings of Stephen Jay Gould (the main foci of this dissertation), particularly with respect to his views on the notion of biological "progress."

Third, another reading of biological "progress" from Michael Ruse; fourth, a bipolar opposite re-reading of the structuralist Darwinian trajectory within (macro-)evolutionary biology through the contributions of Simon Conway Morris; fifth, a re-reading and expansion on Peirce's "evolutionary developmental teleology"; and sixth, a distinctly constructive theological appropriation of amorepotent, uncontrolling *kenosis* based upon an appropriation and amplification of contemporary Wesleyan-relational/Process scholar, Thomas Jay Oord's positions.

This dissertation unabashedly further displays a Christian orientation, since I have been considerably molded by the Wesleyan-/Arminian-Relational theological tradition; as such, this project unapologetically reflects that lineal descendance with the intent of also contributing to it. As a result, this project is invariably colored by Wesleyan views of God and the God-world-human relationship, grounding the endeavor firmly within the Christian tradition. However, the intended audience for this project goes beyond the Wesleyan tradition to the Church-ecumenical.

More specifically, this project is devoted to theologically exploring (macro-)evolution within the context of evolutionary biology, which functions to ground this work within the broad Darwinian trajectory. Recognizing that my former training and practical experience in the biological sciences have significantly shaped me, this project reflects a stout scientific perspective, though to reiterate: I am dialoguing with evolutionary biology so as to flesh-out my distinctly theological position and in order to maximize its traction in the (late-)modern context. Related to that notion, I acknowledge my “developed” (or is it “natural”?) naturalistic-bent and thus attempt to bridle it so that it may not consume the constructive portion of my venture. I project that my disposition toward the evolutionary sciences is evident in my ceding more to them than what some theologians—including many from my own theological tradition—might like.

Fifth, while I do not agree with all elements of Amos Yong’s theological method, to be discussed briefly below, I do favor many parts of his methodology, insomuch as I adopt most of it in this dissertation, with my own personal flare added unto it. Indeed, throughout this project, a pneumatological (Yong) and *kenotical* (McCall) assist is explored by and through which an amorepotent, panentheistic contingentist account of (macro-)evolution is provided that places the evolutionary epic (or play) within the domain of the *kenotical* Spirit. The three main divisions of this book, at the meta-level, are signified by beginning with a scholar of evolutionary biology (science), then proceeding through an exploration of scholars related to the theology and evolutionary biology (science) discussion, only to end up at a purely theological position. These movements correspond, broadly, to the Roman numerals in the table of contents, and also reflect my desire to arrive at a distinctly theological position by the end of my work. After all, I hope to

add to the constructive interface of systematic theology in conversation with a robust panentheistic pneumatological narrative for the derivation and sustenance of the evolving natural world.

Sixth, my methodology also employs the multidisciplinary approach of the Pneumatological Imagination (which describes the dynamic of humanity's epistemological nature that is open to and informed by God's Spirit) espoused by Yong in *Spirit-Word-Community: Theological Hermeneutics in Trinitarian Perspective* (2002). Yong suggests therein that (late-)modern theology cannot be divorced from a person's *Sitz im Leben*, and thus only a comprehensive method can provide an adequate foundation for human situatedness within the world. He notes, in fact, that "a hermeneutics of the divine that fails to properly account for the interpretation of the extra-Scriptural world will ultimately sabotage the theological task regardless of how polished one's biblical canonical hermeneutics is" (Yong 2002, 7). Therefore, biblical hermeneutics cannot be the sole feature of one's theological methodology, though they might or even (possibly?) should appear in such. From discourse with Yong, I maintain that the Spirit of God is at work in countless forums, in countless manners, and in countless guises within the natural world. I suggest that this Pneumatological Imagination adds significant vigor to my overall re-imagining of divine involvement—or, as it is more commonly known as, divine activity—in the contemporary context.

Yong offers a multidisciplinary approach to theology that is informed by (Charles Sanders) Peircean pragmatism, which is one reason that I have chosen to use it herein (note that Peirce himself appears in chapter 5 of this project). Yong maintains that interpretation always

involves at least three components: (1) the subject; (2) the object of inquiry; and (3) the context in which the collaboration occurs. Thus, the interaction of these three components in a three-stage interpretive process is what ultimately generates understanding. Summarizing this process, Yong writes: "Our engagement with the otherness of the world and of reality (Secondness) results in the sensations of qualities (Firstness) according to the general and vague legal features (Thirdness) governing the object of engagement" (Yong 2002, 153). Yong adds, "The logic of pragmatism is that the vagueness of perception and perceptual judgment lead us to formulate equally vague inferences (abduction), from which more specific predictions are made (deductions), which are in turn finally tested in a variety of ways (induction). As these are continuously confirmed, inductive experience is shaped into provisional habits that inform our action" (Yong 2002, 155–56).

Yong rightly recognizes that human knowledge is a constant task of correcting perception through trial and error, as well as a constant negotiation between object, subject, and context. For Yong, any theological method must be consonant with the complexity of the realities that theology addresses and attempts to comprehend. Hence multidisciplinary tools are needed, besides biblical and theological resources, if theology is to talk meaningfully about God in relationship to the contemporary (read scientific) world. According to Yong, his approach offers a more holistic understanding of reality that is sometimes absent in traditional theological frameworks. This perspective, which seeks to correlate theology with reality, I contend presents implications for a theology from below regarding evolutionary biology particularly. But some

"translation" must take place in order for it to fit the purposes of this dissertation, for Yong is explicitly writing of a theology of religions, as well as the various spirits in the world.

In his early work, Yong's focus is primarily oriented to the area of discernment (Yong 2002),[6] wherein he maintains that ontological dualism must be rethought. If (late-)modernity thinks only nature or materiality exists, and traditional Christians therefore counter that there is a supernatural or spiritual domain, then Yong seeks to go beyond such a dualistic construal toward a more dynamic theological conceptualization (Yong 2002, 141). Yong builds upon his theology of discernment in *Beyond the Impasse: Toward a Pneumatological Theology of Religions* (2003). Here his view of discernment is consistent with his earlier work, but is further developed within the framework of a pneumatological approach to the theology of religions. He asserts that previous attempts at interreligious dialogue are limited by their focus upon Christology, whereas pneumatology may open up new avenues of exploration.

Yong writes, "It is precisely because the Spirit is both universal and particular, both the Spirit of God and the Spirit of Jesus the Christ, that pneumatology provides the kind of relational framework wherein the radical alterity—otherness—of the religions can be taken seriously even within the task of Christian theology" (Yong 2003, 21). For Yong, a pneumatological lens helps us to engage other religions in innovative and constructive ways. Using the Irenaean analogy of the two hands of God, he maintains that the Christ and the Spirit are inseparable, which means that theology can recognize the operations of the Spirit in other religious traditions without neglecting the salvific work of the Christ in Christianity (Yong 2003, 169).

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[6] This emphasis on discernment is central not only to *Spirit-World-Community* (2002), but also to Yong's book *Discerning the Spirit(s): A Pentecostal-Charismatic Contribution to Christian Theology of Religions* (2000).

I desire to coopt this understanding of Yong's with regard to "other religions" and apply the underlying point to how God the Spirit may operate in and through other domains than just theological systems of thought, in this case through evolutionary biology. From Yong's theology of religions presented above, I perceive implications for my own understanding—from below—of how God's *kenosis* of the Spirit works through evolutionary biology to attain her ends (*telos*). First, the Spirit can operate in any area of life, not only in other religions but also in evolutionary biology. Second, traditional Christianity has often labeled evolutionary biology as proverbially of demonic origin. Accordingly, third, the discernment of the spirits is a necessary component of comparative theology, whether that be of religions properly so-called, or systems of thought (like evolutionary biology). Yong writes, "To discern a thing is to be sensitive to its complexity. Proper discernment allows us to engage the… influences on a thing at the right level, in the right places, and with the right methods, so that we are able to restore what is malfunctioning to its divinely ordered purposes" (Yong 2003, 158–59).

Core Concepts of This Dissertation

In this dissertation, I present the evolutionary biology of Stephen Jay Gould in particular, as well as some salient insights from Michael Ruse and Simon Conway Morris, as a way of doing theology from below. I am partaking of a deep drink in biology, particularly evolutionary biology, because I am most(ly) interested in theological questions. This may sound strange to the reader at first. After all, what hath Jerusalem to do with Athens? But as I attempt to demonstrate in this dissertation, I think they have quite a lot to do with each other. In fact, I stipulate that a (late-)modern, renewed natural theology from below emerges from my dialogue with theology

and evolutionary biology as outlined in this dissertation, even though I am a little weary and wary of the terminology "natural theology." Nevertheless, I am writing this dissertation as a sort of natural theology from below regarding what content we give to the *imago dei* if evolutionary biology is our only guide.

I shall be criticized for trying to compress these topics into five thousand, eight thousand, or even ten thousand words chapters, as well as compressing Darwin's ideas mainly into one chapter, I am positive. But Darwinian thought both underlies the entirety of the argument, and is—somehow and in some manner—present on every page. My answer to this potential criticism also lies in the fact that some people may read these "sketches," as I affectionately refer to them in this dissertation, who would not read a textbook of these subjects. Moreover, I contend that if I have not failed completely in my intentions, some who have read what I have written will go on to read veritable textbooks. If they do, they might do worse than remember that even great textbooks leave a great deal out.

There are, however, very good biological reasons that suggest—perhaps strongly so—that increased expressions of sentience bring increased levels of adaptation and increased levels of niche construction, which fosters in turn higher net virility and higher biological "fitness." And then, moreover, when greater levels of sentience are achieved, it tends to outperform lower levels of complexity, perhaps manifoldly so. Pointedly, complexity outperforms simplicity, at least in most environments (though there are outliers). God desires relationality with something/someone other than himself, and thus with greater complexity comes more opportunities for the derivation of higher levels of sentience. And with further derivations of

sentience, the possibilities of having a relationship with an entity other than himself greatly increases, and that inevitably and necessarily so.

Because of God's panentheistic relationship with the world, which I presuppose due to my *kenotical* hypothesis of divine presence, God is imminent within the world, and therefore can give rise to causality patterns that we may not be able to fully comprehend scientifically. I am not taking the easy way out by stipulating this; that is not at all my intention. Rather, on this side of the *eschaton*, we simply have not the capabilities of discerning the precise ways that God involves himself with his "creation" and the entities that fill it. In this dissertation, I will assume panentheism, not defend it *per se*; instead, I will use it as an assumption, that is, that there is then somewhat some sort of panentheistic causality in the world—namely, that there are things that happen due to the confluence of both divine agency and matter's agency in biological evolution. Matter, then, is not inert in my appropriation, but an active component of material reality instead. This both/and aspect of causality belies both Darwin's and Gould's assumption of either/or causality—that is, that either God did it, or natural selection did it. Divine causality—or, in my terminology, "involvement"—then, is built upon a panentheistic platform in my thinking.

What else can I say theologically if I accept and assume the panentheistic framework? I contend that my re-imagining of *kenosis* is one more thing I can say theologically if I accept the panentheistic schemata. Indeed, the panentheistic relationship of God and world was onset by God's *kenosis* of Spirit into the natural world (that is, the "in-filling" of the Spirit; see McCall 2008). But then, how does biology add content to the notion of *kenosis* as a panentheist? I have had an extremely hard time, I admit, noting the quantitative aspects of what *kenosis* can add to

the conversation. But the qualitative are somewhat easier, it seems. For example, it gives ample demonstration of creator and creature working alongside each other, or what has been called "created co-creators" (see Hefner 1993). If we learn anything from biology about how God and creatures work alongside each other, what are some things that biology teaches us about how creator and creature work alongside each other? I stipulate that this is best illustrated by the primal/secondary causality dichotomy. In so stating this, I assert that God may be the primal cause, or even the primal of primal causes, but God works through secondary causation in the natural world. So then, the biological processes themselves are God acting as co-creator throughout the pageantry and tapestry of evolution. In so doing, God works with matter in order to make matter *matter*.

So, what does theology add, that biology doesn't already explain? I think God's involvement pulls the physical environ and all entities within it toward Godself, increasing the complexity, beauty, relationality, and the diversity of entities thereby. In fact, the tug toward complexity from God manifests itself in increasing levels of "sentience"—however demonstrated in entities—and that is what God is desirous of, that is, his "goal." What does this claim that God pulls entities toward greater levels of sentience mean for evolution? It should be noted that I do not argue for a "directed" evolution, because that would seemingly connote the idea that evolution has a definite starting point and a definite end point. I do not advocate such. Also, the idea of "directed" evolution seemingly means that God is "behind" the process, pushing it forward, also something that I deny. Additionally, "directed" seemingly connotes causality patterns from "A">>>"B">>>"C," so to speak. I advocate, in counter, that God is ever-before

the entity-laden world, pulling, behooving, beckoning, and wooing it forward—ultimately to Godself. So then, in the example just given, in my appropriation, “C” (the end state) would pull “B” (the intermediate state) toward it, which would in turn pull “A” (the initial state) toward it.

Chapter 2: A Conversation with Gould's Evolutionary Biology

An Introduction to Stephen Jay Gould, Contingency and (Macro-)Evolution—The *Contingentist* God

Stephen Jay Gould, though a masterful storyteller in his "popular" discourses, is also a remarkable writer in his more scientifically-oriented works. I employ his storytelling prowess, from both "popular" sources, as well as his more scientific ones, in this dissertation to illustrate that God uses contingency and randomness to eventuate his eschatological "goals" for creation, which include most-maximally the derivation of intensifications of sentience in the natural world and the entities that inhabit it. In so doing, I will give the "meat" of a particularly scientific view upon how God employs Spirit-derived causation (SDC). In this SDC model of causality, each instance of causation involves an efficient causal component, a final causal component, and a chance causal component (cf. Peirce 1998, 115). The efficient aspect of causation is that each event is produced by a previous event, whereas the teleological aspect of causation is that each event is part of a chain of events with a clear tendency, and the chance component of causation is that each event has some aspect that is determined by neither the efficient nor by the final cause. That is, it is marked by contingency.

Synopsis of Position

In defending and expanding Darwin's theory, Gould posits that Darwinism is a two-part series of contingency and conventional causality—i.e., *Chance and Necessity* (cf. Monod 1972). Contingency rules the day, but because there are infinite galaxies for the complexification of matter to occur, our galaxy in particular has stumbled upon it. Contingency is the tendency of complex systems with substantial stochastic components, and intricate nonlinear interactions

among components, to be unpredictable in principle from full knowledge of antecedent conditions, but fully explicable after its actualization. In sum, “In a major revision of Darwinian logic, chance has been elevated, from its traditional and restricted role as generator of raw material only, to a more active part as agent of evolutionary change. . . mak[ing] it an important evolutionary agent of change in both the qualitative and quantitative sense” (Gould 2006, 225).

Brief Biography of Gould

The “sanctified” writings of a particular profession are often among the most misunderstood, largely because so *few* people read them. Stephen Jay Gould’s magisterial works titled *Wonderful Life* (1989c) and *The Structure of Evolutionary Theory* (2002) rest prominently among such works in evolutionary biology, in my opinion. Gould (b. 10 September, 1941; d. 20 May, 2002) was an American paleontologist, evolutionary biologist, and highly popular and successful “popular” science writer, constructing hundreds of weekly articles for *Natural History* magazine. Gould’s life gave credence to the motto of the American Paleontological Society: *Frango ut patefaciam*—“I break in order to reveal.” And “break” he did, throughout his illustrious career. Also, one might say that he “revealed” quite a measure of truth as well. Nevertheless, Gould was born in New York City, and traced his lifelong interest in paleontology to an encounter as a five-year-old with a dinosaur skeleton in the American Museum of Natural History while residing there in New York.

After obtaining a geology degree from Antioch College in 1963 C.E., he entered a joint graduate program at the American Museum of Natural History of New York with Columbia University (which is also located in New York). Later, in 1967 C.E., Gould was appointed

assistant professor at Harvard University, where he "joyfully" took on the teaching of undergraduate non-majors in science. According to renowned students, Gould's style of lecturing was unconventional, as he often used clever illustrations and examples from both history and art. In his writings, notably, the frequent digressions and allusions to both history and art sometimes challenge the reader; bulleted points were not to Gould's liking—he would rather meander in a story-like fashion, perhaps allowing his "popular" discourses to influence the way he wrote generally.

While Gould's primary contribution(s) was to the theory of evolution, he nevertheless was no stranger to field-work. Indeed, his graduate research was conducted on the evolution of the land snails of Bermuda, upon which he continued work throughout his career. Gould first detected the phenomenon of morphological stasis punctuated by periods of rapid evolutionary change in the land snail *Poecilozonites*, which later led him and Niles Eldredge to the theory of "punctuated equilibrium" in 1972 C.E. In their original 1972 C.E. article, they contrasted "punk eek" with "phyletic gradualism," that is, the gradual transformation of one species into yet another. Stasis is employed in the punctuated equilibrium model as evidence for a centripetal force in evolution; it implies a set of "genetic and developmental coherences that resist selective pressures of the moment and impose a higher level, or macroevolutionary, constraint upon changes within local populations" (Gould and Eldredge 1983, 366).

Gould's best-known work is probably *Wonderful Life* (1989c), which recounts the story of the reinterpretation of the remarkable early animals of the Burgess Shale in British Columbia by Harry Whittington and his students, notably including Simon Conway Morris. Gould's

magnum opus, *The Structure of Evolutionary Theory* (2002), was published just a few months before he died, and appears to be his "most reasoned judgments," so to speak, on the topic(s) of evolutionary theory at large. This latter book was twenty years in preparation and constitutes more than 1,400 pages. In a one-liner, one could say that it traces the history of ideas on evolution comprehensively. In it, Gould considers the main challenges to a Darwinian understanding of evolution to be the following: (1) that evolution is hierarchical, operating not only on genes but also on species; (2) that natural selection is not the only engine of evolution; and (3) that major perturbations—catastrophic events—greatly influence the fate of evolutionary groups, not mere Darwinian mechanisms. He then presents his own synthesis of evolutionary theory in this magisterial work known as *TSoET*. This is the very reason why I allot so many words to *TSoET* in this dissertation.

Gould was a vigorous opponent of creationism, and particularly the movement to give equal time to creationism teaching in public schools. He believed, rather, that science and religion were "non-overlapping magisteria," that is, they were to simultaneously exist relatively untouched by the "other." His articles—and even his books—are testimony to his life's commitment to making "serious" science, as he was prone to state, accessible to a more general and thereby wider audience. In 1982 C.E., Gould was diagnosed with mesothelioma, a cancer usually associated with exposure to asbestos. Although this form of cancer did not defeat him, twenty years later, he succumbed to a different form of cancer that spread too rapidly before it was detected (probably due to his long-held chain-smoking, but that is a topic for another day… and book).

The Development of Gould's Positions

In the course of his graduate studies, Gould's love of history in the broadest sense spilled over into his empirical work as he began to explore the role of one of history's great theoretical themes—contingency, which is the tendency of complex systems with substantial stochastic components, and intricate nonlinear interactions among components, to be unpredictable in principle from full knowledge of antecedent conditions, but fully explainable after its unfoldings, or actualizations. Gould's work in the history of science and the science of contingency led to several articles on the pageant of life's history (see, e.g., Gould 1996b). Although *The Structure of Evolutionary Theory* (2002) treats general evolutionary theory and its broad results (pattern vs. pageant), rather than contingency and the explanation of life's particulars, the science of contingency must ultimately be integrated with the more conventional science of general evolutionary theory as explored in *TSoET*—for one shall thus attain the best possible understanding of both pattern and pageant, and their different attributes and predictabilities.

As Gould began his professional preparation for a career in paleontology, vague feelings of dissatisfaction with the Darwinian premise that (micro-)evolutionary mechanics could construct the entire edifice of evolution just by accumulating incremental results through geological immensity coagulated into central operational foci of discontent. With Niles Eldredge (1972), Gould became deeply troubled by the Darwinian convention that attributed all non-gradualistic literal appearances to imperfections of the geological record.[1] Gould's *TSoET*

[1] See Eldredge and Gould 1972, 82–115. It is noteworthy that Gould's project within *TSoET* is to explore whether he can specify an operational way to define Darwinism in a manner specific enough to win shared agreement and understanding among his readers, but broad enough to avoid the doctrinal quarrels about membership and allegiance that always seem to arise whenever one defines intellectual commitments as pledges of fealty to lists

presents an expansive brief for substantial reformulation in the structure of (macro-)evolutionary theory, with all threads of revision conceptually united into an argument of different thrust and form, but still sufficiently continuous with its original Darwinian base to remain within the same intellectual lineage and logic.

Gould would probably agree with (at least most of) what Jeffrey S. Levinton (2004), professor in the Department of Ecology and Evolution at the State University of New York at Stony Brook, notes about (macro-)evolution in general. In dialogue with Levinton, I assert that (macro-)evolution must needs be a field that embraces the entirety of the ecological theater, which includes the range of time scales for the time-bound evolutionist, as well as the all-encompassing historical changes available only to distinctly paleontological study. It must include the peculiarities of history, which had singular effects on the particular iterations that the earth's biota attained (e.g., the splitting of continents, the establishment of land, as well as the appearance of oceanic isthmuses). It also must take the entire network of phylogenetic relationships into account as well. Then, the nature of constraint over (macro-)evolutionary outcomes must be explained (Levinton 2004, 6). These (macro-)evolutionary foci mentioned above have been largely ignored by the founders of the Modern Synthesis over the past ~75 years, while they have instead devised theories explaining changes in gene frequencies or small-scale evolutionary events, leaving it to "someone else"—whoever that "someone" might turn out to be—to go through the trouble of working in larger time scales and considering the larger

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of dogmata. Gould's allegiance to Darwinian theory, and his willingness to call himself a Darwinian biologist, does not depend on his subscription to all articles of Darwinian postulation, no more than being a "believer" requires assent to all 95 articles that Martin Luther nailed to the Wittenberg church door in 1517 C.E.; or to all 39 articles of the Church of England, adopted by Queen Elizabeth in 1571 C.E.

historical scale, so important to the extent of (macro-)evolution, that is usually in the purview of the paleontologist.

Kelloggian Classification at the Centennial Birth of Darwin

Notably, for the 1909 C.E. Darwinian birth centennial, Vernon L. Kellogg produced a classic exposition of Darwinian theory, broadly defined, titled *Darwinism Today* (1907)—a volume providing a fair hearing for all varieties of Darwinism, and all alternative (and auxiliary) views in a decade of maximal dissent to and diversity in evolutionary theories. Kellogg's book adopts essentially the same premise as Gould's *TSoET*—that is, Darwinism embodies a meaningful central logic, or "essence," and that other proposals about evolutionary mechanisms can be classified with reference to their consonance or dissonance with these basic Darwinian commitments. Indeed, Kellogg's categories, though differently named and parsed from Gould's, are essentially identical with those that Gould recognizes. Kellogg divides the plethora of diversity in then-current Darwinian proposals into those "auxiliary to" and those "alternative to" Darwin's theory of natural selection. Markedly, Kellogg recognized hierarchy as an auxiliary, not a confutation, to Darwinism, and it is noteworthy that this same contention sets a principal theme of Gould's *TSoET*. In his second category of confutations, Kellogg identified "three general theories, or groups of theories, which are offered more as alternative and substitionary theories for natural selection than as auxiliary or supporting theories" (Kellogg 1907, 262): one as functionalist as Darwinism, but offering a different explanation of adaptation—that is, Lamarckism (oft short-changed as merely the inheritance of acquired characters); and two

structuralist alternatives that denied adaptation must guide the origin of new species—that is, orthogenesis, and heterogenesis (the latter being Kellogg's designation for saltationism).

The then-current state (ca. 1907 C.E.) of evolutionary theory required restriction (or constriction) for further advancement—either a settling upon one of the four contenders (Darwinism plus the aforementioned three challengers), or a new formulation altogether. The first phase of the Modern Synthesis accomplished this settling of ideas in three major moves: (1) by choosing the Darwinian central core as a proper and fundamental theory; (2) by reading Mendelism in a different way to validate, rather than to confute, this central core; and (3) by utilizing this fusion to ban the three alternatives of Lamarckism, saltation, and orthogenesis. Kellogg clearly states that the logic of all three alternatives stands squarely against natural selection if we argue for prevailing strength of effect and relative frequency: "All of these theories offer distinctly substitutional methods of species forming" (Kellogg 1907, 262). Kellogg, however, showed particular sensitivity to the nuances, shadings and subtleties that arguments about relative frequency always impart to natural history that others, in subsequent history, have seemingly forgotten.

Kellogg's taxonomy works particularly well in evaluating the central principles of Darwinism. His "auxiliaries" aid selection (by addition of other principles that do not challenge or diminish natural selection, but by expansion of selection to other levels); but his "alternatives" confute specific maxims of the minimal commitments for Darwinian logic. Kelloggian "alternatives" all deny the fundamental postulate of creativity for Darwin's principle of natural selection by designating other causes as originators of evolutionary novelties, or by relegating

selection to a diminished status as a negative force. Each alternative rejects a necessary Darwinian postulate about the nature of variation: (1) Lamarckism and orthogenesis deny the principle of undirected variability; and (2) saltationism refutes the claim that variation must be small in extent.

Kellogg also recognized that "milder" versions of these three banned theories might be seen as auxiliary—not consonant to be sure (for the nonselectionist logic cannot be contravened)—but supplementary rather than substitutional. Thus, for example, if acquired characters are inherited only rarely and weakly, then Lamarckism might aid natural selection in developing adaptation more quickly (by secondary reinforcement)—a position that is advocated, notably and for some reason forgotten-ly, by Darwin himself throughout the *Origin* (Darwin 1859, 134–39, e.g.). But if acquired characters are inherited faithfully all the time, then natural selection will be overwhelmed and Lamarckism thereby becomes a refutation of Darwinism. Relative frequency, then, determines the distinction. Kellogg writes: "Few biologists would hold any of these theories to be exclusively alternative with natural selection… [they] would restrict natural selection but little in its large and effective control or determination of the general course of descent" (Kellogg 1907, 262). I agree with Kellogg here, unreservedly.

Kellogg treated the concept of natural selection with the greatest of respect, noting its internal coherency. Kellogg also recognizes and praises the battle that Darwin had with himself, as recorded in his numerous notebooks (see Darwin 1987b), which in truth was one of the great mental struggles of hominid history—with Darwin proposing and rejecting numerous theories along his gradual and almost painful journey by inches towards the theory of natural selection.

That theory, when fully formulated in the 1850s, emerged as an intricately devised amalgam of logically connected parts, each with a necessary function—and not as a simple message from nature. We must treat Darwin's theory of natural selection, as Kellogg does, with respect for its internal integrity, even though both Gould and I desire to expand and enrich the principles laid forth by Darwin into a (more) coherent theory for the twenty-first century context. Having mentioned Kelloggian "alternatives," I now transition to a (late-)modern case in point: Gould's revisions to the Neo-Darwinian paradigm.

Conventional Paleontological Understanding, Rudyard Kipling, and D'Arcy Thompson

In accordance with the conventional evolutionary understanding, the study of (macro-)evolution became virtually nonoperational in the twentieth-century—as one almost never found this anticipated form of gradual (micro-)change up geological sections, so one therefore had to interpret the predominant signal of stasis and geologically abrupt appearance as a sign of the fossil record's imperfection, and thus as no empirical guide to the nature of evolution. Additionally, at the higher level of evolutionary trends within groups that interbreed (clades, i.e.), the majority of well documented examples of this phenomenon have never been adequately explained in the terms demanded by Darwinian convention—that is, as adaptive improvements of constituent organisms in anagenetic sequences. After all, the criterion of ancestral survival is problematic for this view in that ancestral species overlap in time with descendants (in most cases) in species evolution, which is not expected from gradual transformations by anagenesis. While abrupt appearance in the fossil record may indeed record an absence of information, stasis is data. Thus, the stasis everywhere apparent in the only

proverbial recollection of past life that we have—i.e., the fossil record—should not be dismissed so lightly. Instead, most so-called explanations of evolution in general amount to little more than what Rudyard Kipling, calls “just-so stories”: plausible claims without verified evidence, whereas other prominent trends could not even generate a plausible story in adaptationist terms at all (see Gould and Lewontin 1979). For Gould, the case for an external and objective coherence of his alternative view of evolution is even stronger because he gathered the independent items in ignorance of their coordination, and also at a time when he held a conventional view of Darwinian evolution that actively denied their critical unity and meaning.

Gould, indeed, began in science as a firm adaptationist, “utterly beguiled” by the absolutist beauty of asserting that all aspects of organismal phenotypes, even the most trivial nuances, could be fully explained as adaptations built by natural selection alone (Gould 2002, 40). Truly, Gould was trained as a strict adaptationist, and he accepted and vigorously promoted this worldview in his early papers, with such statements as, “I acknowledge a nearly complete bias for seeking causes framed in terms of adaptation” (Gould 1966, 588); and “the fundamental problem of evolutionary paleontology [is] the explanation of form in terms of adaptation” (Gould 1967, 385). These early works later embarrassed Gould. Indeed, against this orthodox background—or, rather, within it—Gould worked piecemeal, producing a set of separate and continually accreting revisionary items along each of the branches of Darwinian central logic, until he realized that a Platonic something “up there” in ideological never-land could coordinate all these critiques into a revised general evolutionary theory with a retained Darwinian base.

In part because of D'Arcy Wentworth Thompson's incomparable prose within *On Growth and Form* (1917), Gould came to realize the utility of some Platonic, structuralist-type thinking. At the time, in the late 1960s, Gould mercilessly attacked the non-Darwinian (or structuralist) components of Thompson's theory. However fascinated Gould was by structural constraint and correlation(s) of growth, he nevertheless then thought that his task assuredly must center upon a restoration of pure adaptationist themes to this holdout bastion of formalist thought. Remarkably, however, Gould is now embarrassed by the fervor of his former adaptationist convictions (Gould 2002, 42).

(Macro-)Evolution and Constraint

Although the directing of evolutionary change by forces other than natural selection has loosely been described as "constraint," the term, even while acknowledged as a domain for exceptions to standard Darwinian mechanisms, has almost always been conceived as a "negative" force or phenomenon, a mode of preventing (through lack of variation, for example) a population's attainment of greater adaptation. But in contrast to complacent conventionalities, constraint in science (and in vernacular English as well) also has strongly positive meanings in two quite different senses: first, empirically—as channeled directionality for reasons of past history (conserved as homology or by physical principles); and second, conceptually—as a nonstandard force (therefore interesting *ipso facto*) acting differently from what Darwinian orthodoxy predicts (Gould 2002, 1032–33). The classical and most familiar category of internal channeling (the empirical citation of constraint as a positive theme) resides in preferred

directions for evolutionary change supplied by inherited allometries[2] and their phylogenetic potentiation by heterochrony.[3]

Indeed, the meanings and derivations of constraint are varied and complex. The Latin root *stringere* means both to compress or to draw tight (the negative connotations), but also to move, affect or touch (the positive aspects). The prefix con, meaning "with" or "together," brings entities into a field of change or compression. Thus, constraints can surely be negative—as when I, as a miscreant (in a previous decade), was tossed into jail in order to keep me close to other miscreants and to restrict our movements. Constraints, however, can also be positive, as when we force a group of items into closer conjunction so that their combined power and speed can grow and also become more focused in a direction towards a definite goal—as particularly highlighted in the increased speed of fluids in narrowed pipes, according to Bernoulli's principle. While English usage favors the negative connotations, the positive meanings remain current, and certainly sanctioned both historically and linguistically.

Gould believes that we should regard this terminological ambiguity of constraint as positive in its capacity to question accepted ways of thinking (Gould 2002, 1061). Indeed, in the Darwinian tradition, for example, the strategy to deal with constraint is to admit the historical inputs, but to attribute their cause to natural selection in the past; then to admit the structural inputs as genuine exceptions, but relegate them to a low and insignificant relative frequency.

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[2] The study of allometry, that is, how an organism's traits change with their size, helps biologists understand evolutionary processes, and assess relationships between traits (that is, comparative studies), since many traits (morphological, physiological, and life-history) are correlated with size.

[3] Heterochrony can be defined as change to the timing or rate of development relative to the ancestor. Because organisms generally change in shape as well as increase in size during their development, any variation to the duration of growth or to the rate of growth of different parts of the organism can cause morphological changes in the descendant form.

Thereby, all constraints either record the operation of the canonical selection mechanism in the past, or stand as genuine exceptions rendered impotent by their rarity. So then, positive meanings of constraint can lead to important extensions of evolutionary theory by questioning and reformulating the functionalist attribution of effectively all substantial evolutionary change to natural selection.

Rudolph Raff (1996) epitomizes the importance of constraint for a revised and enriched version of Darwinian theory particularly well, and I will quote him directly below:

> A long-standing and important theoretical conception of the relationship between development and evolution is that of developmental constraints. The idea that developmental rules can direct or constrain the course of evolution has two origins. A number of evolutionists, particularly in the generation following Darwin, took antiselectionist positions, and posited that internal forces direct evolution and produce long-term trends independent of the external environment. That is not a tenable position, but neither is extreme selectionism. Internal genetic and developmental constraints of various kinds must exist, but… they are diverse and poorly understood. Yet if internal factors constrain evolution, they are hardly a minor issue. The acceptance of internal constraints does not mean that Darwinian selection is unimportant, but it does mean that the variation presented to selection is not random (Raff 1996, 428).

Various pleas, heard with increasing frequency during the last generation of the twentieth-century (or so), to put the organism back into evolution—or, i.e., to reestablish a meaningful science of morphology—should be understood as a growing conviction that theories

of part-by-part functionalism cannot explain the major patterns of life's history and current morphological distribution (fully, anyway). Gould (at least, the "late" Gould) contends that we need to reformulate, in modern and operational ways, the old notions of organic integrity and structural determination from the "inside" of development, thus balancing our former functionalist faith in the full efficacy of adaptationism with positive concepts of internal and structural constraint. Only in this way can biologists forge a unified science of form to integrate the architecture and history of organisms with their daily struggles to survive, prosper, and propagate in a complex ecological manner (Gould 2002, 1057).

D'Arcy Thompson's (1917) idiosyncratic, but brilliantly crafted and expressed, theory of form presents an early twentieth-century prototype for the generalist form of structural constraint: i.e., adaptation produced not by a functionalist mechanism like natural selection (or Lamarckism), but directly and automatically impressed by physical forces operating under invariant laws of nature. This theory, notably, enjoyed some success in explaining the correlation of form and function in very simple and labile forms of life (particularly as influenced by scale-bound changes in surface/volume ratios). Non-genetic (and non-phyletic) explanations do not apply, however, to complex creatures, and even Thompson admitted that his mechanism could not encompass "hippo-ness" as such, but—at most—only the smooth transformations of these basic morphological designs among closely related forms of similar *Bauplan*. Thompson, although a great student of Aristotle, erred in mixing the master's modes of causality in part by assuming that the adaptive value (final cause) of well-designed morphology could specify the

physical forces (efficient causes) that actually built the structures. We will return to my conceptioning of these types of causality later, in another chapter within this dissertation.

One Long Argument

In the opening sentence of the *Origin's* (1859) final chapter, Darwin famously wrote that "this whole volume is one long argument" (Darwin 1859, 459). Gould's book, on *The Structure of Evolutionary Theory* (2002), is also a brief for an explicit interpretation that may be portrayed as a single extended argument. Although Gould thinks that our (best) current formulation of evolutionary theory includes modes of reasoning and a set of mechanisms substantially at variance with strict Darwinian natural selection, the logical structure of the Darwinian foundation remains remarkably intact. As a primary theme for his "one long argument," Gould claims that an "essence" of Darwinian logic can be defined by specifying a set of minimal commitments, or broad statements, so essential to the central logic of the enterprise that disproof of any item will effectively destroy the theory, whereas a substantial change to any item will convert the theory into something still recognizable as within the *Bauplan* of descent from its forebear, but as something sufficiently different to identify with a new name. Under this premise, the long argument of *TSoET* then proceeds according to three sequential claims that set the structure and order of it:

1. Darwin himself formulated his central argument under three basic premises, or what Gould calls "agency," "efficacy," and "scope," which refers to Darwin's formulation of the overproduction of offspring, variation by some means, and heritability in some manner of that variation.

2. As (macro-)evolutionary theory experienced its growing pains and pursued its founding arguments in the late-nineteenth and early-twentieth centuries, these three principles of central logic—"agency," "efficacy," and "scope"—defined the themes of deepest and most persistent debate. And,
3. As the strict Darwinism of the Modern Synthesis prevailed and "hardened," which culminated in the over-confidences of the centennial celebrations of 1959 C.E., a new wave of discoveries and theoretical reformulations began to challenge aspects of the three central principles (i.e., "agency," "efficacy," and "scope") anew—thus leading to another fascinating round of development in (macro-)evolutionary theory, extending throughout the last three decades of the twentieth-century and continuing into the twenty-first.

Gould prefers to view the history of the Modern Synthesis under a rubric and terminology developed by himself and William B. Provine, the noted historian of science, as a "restriction" followed by "hardening," with the first process viewed as largely admirable, the second as mostly dubious.[4] This hardening of the Synthesis extended beyond confidence in adaptation to a strong(er) contention that the truth of evolution had then been discovered, and that a full account of evolution only required some elaboration of the details.

Central Tenets of The Structure of Evolutionary Theory

The central thesis of *TSoET* can be stated positively and succinctly: much of the evolutionarily significant portion of variation is discontinuous, mechanically and chemically

[4] Always having a knack for a catchy phrase or turn of words, Gould christened this change as the "hardening" of the Synthesis by writing a couple of papers on the subject. See, e.g., Gould 1980, 153–172; and Gould 1982b, xvii–xli.

built through heredity, and often well-formed (and therefore potentially useful) by intrinsic construction; the primary cause of evolution, a process that also tends to be discontinuous, must therefore be located directly in the rules, patterns and directions of change.[5] The overarching question that Gould pursues in *TSoET* is whether "Darwinism" or "Darwinian theory" can be treated as an entity with defining properties of "anatomical form" that permit us to specify a beginning, and to judge the subsequent history of Darwinism with enough rigor to evaluate successes, failures and, especially, the degree and character of alterations (?). Gould wrote *TSoET* primarily to elaborate both a critique and revision of strict Darwinism, which is but one reason why I have chosen to explore (and expand?) Gould's viewpoint(s) in this dissertation. In short, according to Gould, "the structure of evolutionary theory" combines enough stability for coherence with enough change to keep anyone in a perpetual mode of search and challenge (Gould 2002, 6).

As Thomas Henry Huxley (1894), the most-excellent nineteenth-century Darwinian famously remarked (in self-reproach for failing to devise the theory himself), Darwin's argument must be deemed elementary (note that the basic thrust of Darwin's hypothesis had often been formulated before, but in negative contexts, and with no appreciation of its power). In view of such, there were three principles that established the range and power of Darwin's revolution in hominid thought. These three larger principles, in defining the Darwinian essence, take the proverbial guts of the machine, and declare its simple operation sufficient to generate the entire

[5] Gould proffers the example of domestic breeds of cats vs. dogs as the classic example—the limited range of realized phenotypes in some interbreeding populations may reflect a structural limit in variation, rather than a lack of selective opportunity or advantage (Gould 2002, 1030).

history of life in a philosophical manner. These three principles that elevated natural selection from the guts of a working machine into a radical explanation of the mechanism of life's history can best be exemplified, according to Gould, under the general categories of "agency," "efficacy," and "scope" (Gould 2002, 14). These three principles are arranged in such a manner as to make the most radical claim first, with assertions of complete power and full range of applicability then following.

Gould develops his argument throughout *TSoET* by asserting, first, that the central logic of Darwinism can be depicted as a branching tree with three major limbs devoted to selection's agency, efficacy and scope. Second, that Darwin, despite his heroic efforts, could not fully "cash out" his theory in terms of the stated commitments on each branch—and that he had to allow crucial exceptions, or at least express substantial fears of such, in each of the above domains. For example, Darwin was forced, so to speak, to admit species selection to resolve the problem of diversity; moreover, Darwin permitted an uncomfortably large role for formalist correlations of growth as compromisers of strict adaptationism. And further, Darwin expressed worry that mass extinction, if more than merely an expression of an imperfect fossil record, would derail the extrapolationist premise of his system. After all, Darwin argues that biotic competition, gradualistically expressed through time as coordinated waxing and waning of interacting populations, marks the overall pattern of life—and that the apparent fossil evidence for more rapid change, set by physical environments and leading to mass extinctions, must generally be read as artifacts of an imperfect record.

Agency Asserted

Regarding *agency*, this is the abstract mechanism that requires a locus of action in a hierarchical world, and Darwin insisted that the apparently intentional "benevolence" of nature, which was embodied in the "good" (enough) design of organisms and the harmony of ecosystems, flowed entirely as side-consequences of a single causal locus; this, by the way, comprised the most "reductionistic" account available to Darwin at the time. Indeed, Darwin insisted upon a single-level theory, which was virtually exceptionless, with organisms acting as the locus of selection, and all "higher" order emerging—by an analog of Adam Smith's "invisible hand"—from the struggles of organisms for their own personal advantage(s). Notably, this process is expressed phenotypically in differential reproductive success. In fact, Darwin's single-minded insistence on the exclusivity of the organismic level—although rarely appreciated by his contemporaries—ranks as the most radical and most distinctive feature of his theory, in my opinion. Later commentators in philosophy of biology have, of course, extended this "reductionism" well-below the organismic level, ultimately to genes and gene products (that is, proteins).

Efficacy Expressed

Regarding *efficacy*, almost any reasonably honest and intelligent biologist could easily understand that Darwin had identified a *vera causa* (true cause) in natural selection. Thus, the debate in his time (and, to a lesser—though palpable—extent in ours as well) never centered upon the existence of natural selection as a genuine causal force in nature. Rather, virtually all anti- (perhaps better: "non-") Darwinian biologists accepted the reality and action of natural

selection, but branded Darwin's force as a minor and negative mechanism, capable only of the executioner's role of removing the unfit, once the fit had arisen by some other route, as yet unidentified. This other route, they asserted, would (one day…) provide the centerpiece of a "real" evolutionary theory, capable of explaining the origin of novelties.

Darwin insisted, however, that his admittedly weak and negative force of natural selection could, nonetheless, under certain assumptions about the nature of variation (which were later proved valid), act as the positive mechanism of evolutionary novelty. That is, it could "create the fit" as well as eliminate the unfit by slowly accumulating the positive effects of favorable variations through practically innumerable generations. It should be noted, though, that Darwin held that this variation, of whatever derivation, must be "copious" in extent, "small" in range of departure from the mean, and "isotropic" (or undirected towards adaptive needs of the organism). In Darwin's system, variation must walk a tightrope between two unacceptable alternatives: first and foremost, variation must exist in sufficient amounts (copious in fact), for natural selection can make nothing, and must rely upon the provisions provided to it by nature; but variation must not be too elaborate or dramatic either, lest it become the creative agent of change all by itself. Variation, in Darwin's system of thought, then, must be copious, small in extent, and undirected. For Darwin, only under these conditions can natural selection—a force that makes nothing directly, and must rely upon variation for all raw material—be legitimately and consistently seen to be creative.

Regarding *copiousness*, since natural selection makes nothing and can only work with raw material presented to its stringent review, variation must be generated in plentiful and

reliable amounts. Darwin's scenario for selective modification always includes the postulate, usually stated explicitly, that all structures vary, and can therefore evolve. Regarding variation being small in extent, Gould contends (in his non-orthodox Darwinian mode) that if the variations which yielded evolutionary change were too large—producing new major features, or even new taxa in a single step—natural selection would not disappear as an evolutionary force, *per se*. Selection would still function in an auxiliary (and negative role) in removing the unfit, and thereby permit a new saltation to spread among organisms in subsequent generations, eventually allowing the new saltatory variety or species to take over the population (Gould 2002, 143). But strict Darwinism, as a theory of evolutionary change, would perish—for selection would only become both subsidiary and negative—and variation itself would emerge as the primary, and truly creative, force of evolution, the source of an occasionally lucky saltation. For this reason, saltationist (or macro-mutational) hypotheses have always been perceived as anti-Darwinian—despite the protestations of Hugo de Vries (1909), for example, who tried to retain and thereafter reclaim the Darwinian label for his continued support of selection as merely a negative force.

Regarding the nature of variation being undirected, it is somewhat regrettable that far too often patrons advocating for (and collegiate textbooks upon) evolution still often refer to variation as "random." Most professionals within the sciences of evolution recognize this designation of random as a misnomer, but strangely continue to use the phrase. Orthodox Darwinians have never, truly, argued for "random" mutation in the restricted and technical sense of pluripotently equal in all directions (as in tossing a set of die). But our sloppy use of random

aside, it does capture, vernacularly, a portion of an important claim that (macro-)evolutionists wish to convey: variation must needs be unrelated to the direction of evolutionary change (see Eble 1999, 75–87). Or, more strongly, that nothing about the process of creating variation can bias the pathway of subsequent change in adaptive directions; that is, it must be isotropic.

This coordinating postulate of isotropy gives strict Darwinism the proverbial flavor of "chance and necessity," written about in Jacques Monod's famous title: *Chance and Necessity: An Essay on the Natural Philosophy of Modern Biology* (1972). Eble, in fact, brilliantly analyzes two entirely distinct, but all too frequently conflated, meanings of "chance" and "randomness" in evolutionary theory (Eble 1999, 76). Eble distinguishes the conventional statistical meaning from the particular and distinctive sense frequently employed in Darwinian literature—i.e., "chance" defined as events occurring for reasons unrelated to the mechanism of natural selection. Eble writes the following: "The gist of the evolutionary notion of chance is that events are independent of an organism's need and of the direction provided by natural selection in the process of adaptation" (Eble 1999, 77). Eble then recommends that we retain the words "chance" and "random," but enforce a separation betwixt the two with the restricting adjectives "statistical" vs. "evolutionary" chance. Eble further argues that "evolutionary studies… can benefit from the simultaneous application of statistical and evolutionary notions of chance"—defining the second concept as "independence from adaptation and the directionality imposed by natural selection" (Eble 1999, 75). I agree entirely with Eble's analysis.

What else but natural selection could be called "creative," or direction-giving, in such a process? For as long as variation only supplies raw material; as long as change is accretive in a

gradual manner; and as long as the reproductive advantages of certain individuals provide the statistical or stochastic source of change; then natural selection should be construed as the directional cause of evolutionary modification. Darwin understood that if any of his claims failed, natural selection could not be a creative force, and the theory of natural selection would collapse.[6] Darwin's constraints on the nature of variation form a single conceptual thrust: variation only serves as a prerequisite, a source of raw material incapable of imparting direction or generating evolutionary change by itself. Gradualism, in the meaning of insensible intermediacy, then guarantees, for Darwin, that the positive force of modification proceeds step-by-(tiny)-step. Therefore, the explanation of evolution for Darwin must reside in specifying the causes of change under two conditions that logically entail a primary focus on adaptation as a canonical result: (1) the general nature of change (gradualism) is known, and an internal source from variation itself (the argument for isotropy[7]) has been eliminated; (2) variational change must, then, arise by interaction between external conditions (both biotic and abiotic) and the equipotent raw material of variation. Such gradual adjustment of one to the other yields adaptation as a primary outcome. It is all very logical. But also too simplistic.

Scope Stipulated

Regarding *scope*, Gould stipulates that even the most unfavorably minded of contemporaries often admitted that Darwin had developed a theory capable of building up small changes of a locally "positive" nature as adaptations to changing environments within a "basic

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[6] Notably, Darwin used the theory of natural selection to deduce a set of necessary properties for variation, well before science understood the mechanism of heredity.

[7] Isotropy is uniformity in all orientations; it is derived from the Greek *isos* ("equal") and *tropos* ("way").

type”—the equivalent, e.g., of making domesticated dogs from wolves or developing edible corn from teosinte. However, these critics could not grasp how such a genuine (micro-)evolutionary process could be extended to produce the full panoply of taxonomic diversity and the apparent “progress” in complexification of morphology (and sentience) through geological time. We will come back to the notion of “progress” in biological evolution in the next chapter.

Darwin, though, insisted on full sufficiency in extrapolation, arguing that his (micro-)evolutionary mechanism, extended through the immensity of geological time, would be fully capable of generating the entire pageant of life’s history, both in anatomical complexity and taxonomic diversity—and that no further causal principles are, therefore, required. I will come back to this contention of Darwin and critique it mercilessly. This being said, however, the contingency of historical details virtually guarantees that any single theory will underdetermine important details, and even general flows at times, in the realized evolutionary pageant (or play) of life’s phylogeny on Earth. Such a claim for non-theoretical independence of (macro-)evolution generates no real dispute amongst (late-)modern biologists.

Darwin’s and Gould’s Imagery of the Coral—“K,” “R,” and “S” Cuts

Gould employs an image of a coral to illustrate his thinking of agency, efficacy, and scope because it greatly captures the imagery that he wishes to convey: one can cut up a coral with a blade, as it were, and the coral will still survive to thrive and expand in new environs. One cannot sever the main trunk, however, or the coral dies. Similarly, Gould’s “cuts” to the strict Darwinian model that arose as the Modern Synthesis hardened (i.e., those which culminated in the Darwinian centennial celebrations of 1959 C.E.), will not kill the coral or remove the

essentialities of Darwinism from it. It will, however, change the dynamics and character of the Darwinian Synthesis.

Indeed, Gould designates three levels of potential cuts or excisions to this organic "coral" of the structure of evolutionary theory, as originally formulated by Darwin in *On the Origin of Species* (1859), and as revised in a (Hugh) Falconerian (1868) way in recent decades. The most inclusive and most fundamental K-cuts (killing cuts) sever at least one of the three central principles of Darwinian logic and thereby destroy the theory. These first-order "branches" are so fundamental that any severance of a complete branch converts the theory into something essentially different that must be newly named. Gould envisions the central trunk and first-order branches as indispensable (Gould 2002, 146). Although, at some level above the base of the coral, one may excise a sub-branch, deny its premises, and still consider themselves Darwinians. Along the continuum from necessary to avoidable, then, one may make selective cuts at the level of sub-branches, but not without severe stress to the entire structure.

However, the second level of R-cuts (revision cuts) removes enough of the original form on one of the three central branches to ensure that the new (and stronger, or more arborescent) coral branch, in regrowing from the cut, will build a theory with an intact Darwinian foundation, but with a general form and content sufficiently expanded, revised or reconstructed to present an interestingly different structure of general explanation—the Falconerian model for the Duomo of Milan (which, of course, has received numerous "updates" throughout the centuries, but amazingly still sits upon the same foundation). A third level of S-cuts (subsidiary cuts) affects

only a subbranch of one of the three major coral branches, and therefore reformulates the general theory in interesting ways, while leaving the basic structure of explanation intact.

Gould believes that all three pillars, branches, or tripod legs—representing the three fundamental principles of Darwinian central logic (i.e., agency, efficacy, and scope)—have been subjected to fascinating R-cuts that have given the contemporary era at least the firm outlines for a revised structure of evolutionary explanation, working toward the construction of a richer and fascinatingly different theory with a retained Darwinian core rooted in the principles of natural selection. In short, (late-)modernity is in the midst of a Falconerian remodeling of the growing and multiform, yet coherently grounded, intellectual edifice known as Darwinism. So then, contemporary challenges to all three central commitments of Darwinism (the "legs" of the tripod in Gould's chosen metaphor, or the "essence" of the evolutionary theory in the legitimate use of a word generally shunned by evolutionary biologists) prompted him to write *TSoET*.

In *TSoET*, indeed, Gould writes most often of a "tripod" since central Darwinian logic embodies three major propositions that Gould has always visualized as supports. The image of a tripod also suits Gould's major claim particularly well—for he argues herein that we should define the "essence" of a theory by an absolutely minimal set of truly necessary propositions. According to Gould, no structure, either of a hominid's building or of abstract form, captures this principle better than a tripod, based on its absolute minimum of three points for fully stable support in the dimensional world of our physical experience.

Also, if the minimal logic can be represented by a tripod pointing downward, then the same topology can be inverted into a structure growing upward. Darwin's own favorite image of

the tree of life immediately suggested itself to Gould. But he also remembered Darwin's first choice for an organic metaphor or picture of branching to capture his developing views about descent with modification and the causes of life's diversity—i.e., the "coral of life" of Darwin's "B Notebook" on transmutation. This "B Notebook" was kept during the 1830s as Darwin first became an evolutionist and struggled towards the theory of natural selection (for Darwin's notebooks of this period, see Darwin 1987b). Hence, Gould ultimately opted for the "coral" imagery, as noted above.

Remarkably, Darwin converted (macro-)evolution from untestable speculation to doable science by breaking through the old paradox (as embedded in Lamarck's system) of contrasting a force of small-scale change that could do little in extension, with a basically nonoperational (and orthogonal) mechanism of large-scale change putatively responsible for all the interesting patterns of life's history, but imperceptible and untestable from the uniformitarian study of modern organisms. By claiming that the small-scale mechanics of then-modern change could, by extension and extrapolation, explain all of evolution, Darwin opened the entire field of (macro-)evolution to empirical study. And yet, as Hegel and so many other students of change have famously noted, progress in hominid (and other) affairs tends to spiral upwards in cycles of proposal (thesis), then countered by opposition (antithesis), and finally leading to a new formulation combining the best aspects of both competitors (synthesis). While Darwin's thesis established (macro-)evolution as a science, his essential commitments, as expressed in the three legs of his necessary logical tripod (or the three branches of his conceptual "coral"), Gould contends, eventually proved too narrow and confining, thus requiring an antithesis of extension

and reformulation on each branch. This antithesis, then, leads to a still newer and richer synthesis expressing our best current understanding of the structure of evolutionary theory.

Additionally, for Gould, the subsequent history of evolutionary debate has focused so strongly upon the key claims of Darwin's three essential branches (agency, efficacy, and scope) that one may use engagement with them as a primary criterion for distinguishing the "central" from the "secondary" when one needs to gauge the importance of challenges to the Darwinian consensus. One should not be surprised by the prominence of these three themes, for they embody in biological specificity the broadest underlying issues in scientific explanation, as well as in the nature of change and history: e.g., (1) levels of structure and causality; (2) rates of alteration; (3) directions of causal flow; (4) the possibility of causal unification by reduction to the lowest level vs. autonomy and interaction of irreducible levels, (5) punctuational vs. gradual change; (6) causal and temporal tiering vs. smooth extrapolation, et cetera.

Further, our best contemporary understanding of the structure of evolutionary theory has reversed the harmful dichotomization of earlier debates (Darwinian fealty vs. destructive attempts to trivialize or overturn the mechanism of selection) by confronting the same inadequacies of strict Darwinism, but this time introducing important additions and revised formulations that preserve the Darwinian foundation, while building a theory of substantial expansion and novelty upon a retained selectionist core (Gould 2002, 54). Indeed, even during the period of current orthodoxy, beginning with the coalescence and spread of the Modern Synthesis, the three supports (or legs) have never been particularly firm, or adequately defended. The first support—restriction of selection to the organismal level—received little explicit

defense, but rather prevailed in a fuzzy sort of way by convention in practice. The second proverbial leg—validation of selection as a nearly exclusive mechanism of evolutionary change—received strong verbal approbation, and elegant illustration in a few cases, but won orthodox status largely as a bandwagon effect prompted by the incessant urgings of a few central (and highly vocal) figures rather than direct evidence for its plausibility. The third support—extrapolation—prevailed more by assumption than by active validation (see Gould 2002, 586).

Gould displays throughout *TSoET* that the logic of this pronounced expansion builds a theory fascinatingly different from, and not just a smooth extension of, Darwin's single level mechanism of agency (i.e., natural selection). On the second branch of efficacy, for example, the R-cut accepts the validity of Darwin's argument for creativity (by leaving the base of the coral branch intact), but introduces a sufficient weight of "formalist" thinking—via renewed appreciation for the enormous importance of structural, historical, and developmental constraint in channeling the pathways of evolution, often in highly positive ways—insomuch as the pure "functionalism" of a strictly externalist Darwinian approach to adaptation no longer suffices to explain: 1) the channeling of phyletic directions; and (2) the clumping and inhomogeneous population of organic morphospace. The strict Darwinian explanation has thereby been greatly changed and enriched, but in no wise defeated thoroughly. On the final branch of scope, the R-cut accepts the Darwinian contention that (micro-)evolutionary modes and principles can build grand patterns by cumulation through geological immensity; however, it rejects the argument that such extrapolations can render the panoply of phenomena in life's history without adding

(more-so) explicitly (macro-)evolutionary modes for distinctive expression of these processes at higher tiers of time.

This rejection of the argument that such extrapolations can render the panoply of phenomena in life's history is seen, for example, in the explanation of cladal trends by species-sorting under punctuated equilibrium, rather than by extended adaptive anagenesis of purely organismal selection. Also, this particular R-cut indicates the necessity of titrating adaptive (micro-)evolutionary accumulation with the occasional resetting of rules and patterns by catastrophically triggered mass extinctions. As a paleontologist and part-time historian of science by profession, Gould's reading of these important R-cuts arose from a (macro-)evolutionary perspective framed largely in terms of longstanding difficulties faced by Darwinism in extrapolating its successes for explaining small changes in perceivable time into equally adequate causal accounts for broader patterns and processes in geological time.[8]

Darwin's Pinnacle Achievement(s)

In the first stage of debate during the late-nineteenth and early-twentieth centuries, most critiques of Darwinism simply denied sufficient agency, efficacy and scope to natural selection, thereby reasserting the old claim of duality: i.e., with selection relegated to triviality, and some truly contrary force sought as the explanation for major features of evolution. Strict Darwinism eventually fought off these destructive critiques, reasserted itself triumphant, and initially found strength in the generously pluralistic form of the (early) Modern Synthesis. However, this

[8] In this effort, Gould particularly benefited from study of Darwin's life and times, and especially the late nineteenth-century debates on mechanisms of evolution as promulgated largely by professionals who either could not fully understand or accept the radical philosophical commitments underlying Darwin's view.

Modern Synthesis eventually calcified into a “hardened” version that was necessarily self-defeating. Then, in a strikingly different, and ultimately fruitful, second round of antitheses, a renewed debate around central theoretical issues arose during the last three decades of the twentieth-century, and thereby reshaped the field by recognizing that selection needed to be amplified, reformulated and invigorated by other, non-contrary causes. Darwin’s pillar of the theory—natural selection—was then seen to not be rejected as wrong, or scorned as trivial, but in need of dramatic overhaul instead. Gould asserts that good theories grow as good organisms do—with periods of long latencies of youth or ossifications of age, and some happy times of optimally productive motion in between (Gould 2002, 25).

Challenges to Darwinian Orthodoxy

Interdemic Selection, Homologies, and Parallelism

During the last-third of the twentieth-century, new techniques and conceptualizations opened up important sources of data that challenged orthodox formulations of all three branches (agency, efficacy, and scope) of essential Darwinian logic (Gould 2002, 25–26). According to Gould, (late-)modern revisions for each essential postulate of Darwinian logic substitute mechanics based on interaction for Darwin’s single locus of causality and directional flow of effects. Therefore, for Darwin’s near exclusivity of organismic selection, Gould proposes a hierarchical theory with selection acting simultaneously on a rising set of levels, each characterized by distinctive, but equally well-defined, Darwinian individuals within a hierarchy of gene to cell-lineage, to organism, to deme, to species, and then to clade (Gould 2002, 32). The results of evolution then emerge from complex, but eminently knowable, interactions among

these potent levels, and thus do not simply flow out-of and up-from the unique causal locus of organismal selection.

A similar substitution of interaction for directional flow then pervades the second branch of selection's efficacy, as Darwin's functionalist formulation—with unidirectional flow from an external environment to an isotropic organic substrate that supplies "random" raw material but imposes no directional vector of its own to "push back" from internal sources of constraint—yields to a truly interactive theory of balance between the functionalist Darwinian "outside" of natural selection generated by environmental pressures. Couple this "outside" aspect of natural selection with a formalist "inside" of strong and positive constraints generated by specific past histories and timeless structural principles, and voilà, one has the structure of Gould's argumentation. Further, to epitomize the importance of constraint in a single sentence, Gould contends that the concept of non-isotropy in variation may be roughly synonymized with notions of "constraint"—that is, with claims that internal factors restrict the freedom of natural selection to establish and control the direction of evolutionary change (Gould 2002, 1027). My readers will find, in what follows, an amplification of the concept of constrain in evolution. But first, on the third branch of selection's scope, the single and controlling (micro-)evolutionary locus of Darwinian causality yields to a multileveled model of tiers of time, with a unified set of processes working in distinctive and characteristic ways at each scale, from allelic substitution in observable years to catastrophic decimation of global biotas in geologic time. Thus, for the (1) unifocal and noninteractive Darwinian models of exclusively organismal selection, (2) causal flow from an environmental outside to an organismal inside, and (3) a (micro-)evolutionary locus

for mechanisms of change that smoothly extrapolate to all scales, Gould substitutes and articulates (1) a hierarchical selectionist theory of numerous interacting levels, (2) a balanced and bidirectional flow of causality between external selection and internal constraint (i.e., an interaction of functionalist and structuralist perspectives), and (3) causal interaction among tiers of time.

Gould's attitude towards natural selection, however, requires closer scrutiny which aids in clarifying the borderline between two intergrading yet contradictory strategies: (1) using the structuralist and formalist concept of channels in pluralistic reinforcement with natural selection to forge helpful revisions of basic Darwinian theory (the position advocated in *TSoET*). Or, (2) viewing channels as so deep, so unidirectional, and so limiting that such constraints impel evolutionary change (alone) from within, leaving selection only to tinker with minor details (a truly anti-Darwinian theory that the Modern Synthesis rejected completely). Gould seeks to fuse external pushes with internal channels, that is, join the success of this Modern Synthesis with neglected structuralist and formalist themes of developmental constraint and channeled variation.

To cite just one example for each branch of the new techniques and conceptualizations that opened up important sources of data, and that therefore challenged orthodox formulations of all three branches (agency, efficacy, and scope) of essential Darwinian logic, allow me to mention that theoretical development and accumulating data on punctuated equilibrium allowed biologists and paleontologists to reconceptualize species as genuine Darwinian individuals, fully competent to participate in processes of selection at their own supraorganismic level as agential entities. This asseveration, then led to contemporary paleontological rethinking of

(macro-)evolution as the differential success of species, rather than the extended anagenesis of organismal adaptation. This validation of the species-individual also, thereby, aided the transformation of what had begun as a particular argument about group (or interdemic) selection into a fully generalized hierarchical theory, with good cases then documented from the genic to the cladal level.

On the second branch of the full efficacy of natural selection as an externalist and functionalist process, the discoveries of extensive deep homologies across phyla separated by more than 500 million years (particularly Hox and Pax6 genes)—against explicit statements by architects of the Modern Synthesis that such homologies could not exist (in principle) in a world dominated by their conception of natural selection—forced a rebalancing of Darwinian functionalism with previously neglected (even vilified!) formalist perspectives based on the role of historical and structural constraints in channeling directions of evolutionary change. The previous change then led to another one, which caused the great inhomogeneities of morphospace, which were phenomena that had previously been attributed almost exclusively to functionalist forces of natural selection, to also be rethought (Gould 2002, 26). In fact, Gould contends that this parallelism has manifold positive roles, based on common action of regulators shared by deep homology, especially in directing the evolutionary pathways of distantly related phyla into similar channels of adaptations which are more easily generated. Thereby, Gould defines this phenomenon as synergistic and consistent with an expanded Darwinian theory, and not confrontational or dismissive of selection. We shall encounter the concept of parallelism again in a later chapter within this dissertation (i.e., chapter 4).

Notably, as an (important) aside, contemporary genetical theory stipulates that while all entities may share certain genes, and therefore produce the same proteins within them, the "regulators" of the gene products are viewed as the crucial difference. Meaning, then, that when a gene gets "turned-on" is the differentiating factor between different organisms, and especially different *phyla*. Whether this will be looked upon in a generation (or so) as a wise contention, I have no way of projecting. But that is current "orthodoxy" in genetics. Next, we peer into a major metaphor that has truly changed my thinking of the evolutionary and ecological theater.

Revisions to Darwin's Theory(ies)—The Duomo of Milan

Hugh Falconer, the Scottish surgeon, paleontologist and tea grower, sent to Darwin in September, 1862 C.E., a portion of one of his papers that would later appear 1863 C.E. In it, Falconer claims that:

> Darwin has, beyond all his cotemporaries [sic], given an impulse to the philosophical investigation of the most backward and obscure branch of the Biological Sciences of his day; he has laid the foundations of a great edifice; but he need not be surprised if, in the progress of erection, the superstructure is altered by his successors, like the Duomo of Milan, from the roman to a different style of architecture.[9]

In a letter to Falconer dated 1 October, 1862 C.E., Darwin explicitly addressed this passage in Falconer's text; Darwin notes, "To return to your concluding sentence: far from being surprised, I look at it as absolutely certain that very much in the Origin will be proved rubbish; but I expect and hope that the framework will stand" (Darwin 1903, 1:206). Gould's *TSoET* seeks to

[9] See the letter from Falconer dated 24–27 September, 1862 C.E. at https://www.darwinproject.ac.uk/letter/?docId=letters/DCP-LETT-3737.xml.

demonstrate just that idea: i.e., that (late-)modernity must transform Darwinian thought, but that it will retain a Darwinian "look" and "feel" about it nonetheless.

Gould's own view is closer to Falconer than to Darwin, but in accord with Darwin on one key point—which also supplies the organizing principle for the "one long argument" of *TSoET's* entirety: Gould believes that the Darwinian framework persists in the emerging structure of a more adequate evolutionary theory. He also holds, with Falconer, that substantial changes, introduced especially during the last half of the twentieth century, have built a structure so expanded beyond the original Darwinian core, and so enlarged by new principles of (macro-)evolutionary explanation, that the full exposition must be construed as basically different from the canonical theory of natural selection, instead of it being simply extended. That is, it must be expanded while remaining within the domain of Darwinian logic.

Darwin's Rejection of Alternate Theories

Darwin, in his struggle to formulate an evolutionary mechanism during his more than two years between the docking of the Beagle voyage ship and his Malthusian insight of late 1838 C.E., had embraced—but ultimately rejected—a variety of contrary hypotheses including, but probably not limited to: (1) saltation; (2) inherently adaptive variation; and (3) the intrinsic death of species (see Gruber and Barrett 1974; and Kohn 1980, 67–170). A common thread unites all these abandoned approaches: they all postulate an internal drive based either upon large pushes from variation (saltationism) or on inherent directionality of change; i.e., some sort of vitalism (see McCall 2017a). Most of these hypotheses use ontogenetic metaphors, and make evolution as inevitable and as purposeful as development (see, e.g., Gould 1977, for support of this assertion).

Darwin's theory of natural selection, by contrast, relies entirely upon small, isotropic, nondirectional variation as raw material, and views extensive transformation as the accumulation of tiny changes wrought by struggle between organisms and their biotic environment. Trial and error, one tiny step at a time, becomes the central metaphor of orthodox Darwinism. However, this is not "all" of Darwinism; no, Darwin also included some ideas in his *magnum opus* that—seemingly!—"complement" the near exclusivity of change being wrought only by minute steps.

Darwin's Principle of Divergence

Darwin's principle of divergence is a fitting basis of what I desire to expand upon in my (more) constructive section of this dissertation. Darwin's posthumously published autobiography contains many memorable and oft-quoted statements, including his description of an intellectual eureka: "I can remember the very spot in the road, whilst in my carriage, when to my joy the solution occurred to me" (Darwin 1887, 1:84). Ask the standard biologist what this eureka moment was about, and she would probably tell you, "Oh, that refers to his epiphany related to his Malthusian insight of 1838 C.E., that is, when he applied Malthusian principles to his budding theory of wedges in nature, and which ultimately led to his pontifications on natural selection." However, this would be a wrong assessment. Instead, this thunder-struck moment refers to his insight of the principle of divergence. Darwin always thought this principle of divergence ranked with natural selection as his crowning achievement. In fact, this moment, recounted hagiographically by Francis Darwin, allowed Darwin to complete his theoretical structure and onset the writing of his *magnum opus*.

No prominent formalist has ever denied interest or importance to the manifestly obvious phenomenon of adaptation. Formalists do not question the high frequency of adaptation, but only dispute the relative ranking of utility as a causal argument. In the view of functionalists, from creationists like Paley to evolutionists like Darwin, adaptation embodies the source and cause of morphological order and change. For formalists, adaptation becomes a secondary phenomenon, imposed upon primary and underlying laws of form to fit a particular organism to an immediate environment. Adaptation remains vital; for without such specific utility, the organic world would feature only abstract models, but no real creatures in their stunning variety. Yet, adaptation still works in a sequential and secondary fashion to place an overlay upon the archetype in these formalist models (Gould 2002, 324).

Darwin describes the phenomenon that a principle of divergence must resolve, and states his surprise at his own obtuseness before the above-referenced fateful carriage ride:

> But at that time [i.e., after the Malthusian insight of 1838 C.E. and before his composition of the sketch argument in 1844 C.E.] I overlooked one problem of great importance; and it is astonishing to me, except on the principle of Columbus and his egg,[10] how I could have overlooked it and its solution. The problem is the tendency in organic beings descended from the same stock to diverge in character as they become modified. That they have diverged greatly is obvious from the manner in which species of all kinds can be classed under genera, genera under families, families under suborders, and so forth…

[10] I was confused by this expression, but it seems as though it refers, in German as well as Spanish, to solving a difficult problem in a surprisingly simple manner, at least according to my old German professor at Regent University, Dr. Wolfgang Vondey (personal communication).

> The solution, as I believe, is that the modified offspring of all dominant and increasing forms tend to become adapted to many and highly diversified places in the economy of nature (Darwin 1887, 1:84).

Natural selection, as formulated under the Malthusian insight of 1838 C.E., states a principle of anagenetic change within phyletic lines—an argument about adaptation to local circumstances (biotic and abiotic). This principle says nothing, in and of itself, about diversification, or the splitting of one lineage into two or several descendant taxa.

One might say that "divergence of character" requires no separate principle beyond adaptation, natural selection, and historical contingency. After all, the earthly stage of evolution provides ecological and bio-geographical prerequisites for diversification—climates alter; topography changes; populations become isolated, and some in and by adapting to changing environments, form new species. What more, then, might one need? Insofar as Darwin considered the issue at all between 1838 C.E. and the early 1850s, his thinking apparently followed this general line, at least that is, according to Sulloway and Ospovat (see Sulloway 1979 and Ospovat 1981). Darwin grew dissatisfied, however, with a theory that featured a general principle to explain adaptation, but then relied upon historical accidents of changing environments to explain diversity. He decided, instead, that a fully adequate theory of evolution required an equally strong principle of diversity, one that acted intrinsically and predictably. If adaptation and diversification specify the central phenomena of evolution, each must have its own principle, and their union thereafter would then define his complete theory as presented in 1859 C.E.

There was, apparently, a growing intensity of Darwin's search for a "law-of-nature" explanation of divergence that resulted in his changing views about what we now call allopatric and sympatric speciation after the publication of the *Origin* in 1859 C.E. Indeed, during the 1840s, when diversity did not greatly trouble him as a theoretical issue, Darwin tended to view speciation as what we would call "allopatric," and therefore as a consequence of historical accidents in geography and ecology. When a population becomes spatially isolated, he reasoned, natural selection can act independently upon it, and eventually accumulate enough divergence from the ancestral form to establish a new species. But Darwin's preferences then (apparently) shifted to what we call "sympatric" views of speciation—and he therefore developed a conviction that some general law, and not just historical accidents of isolation, must promote the multiplication of species. A complete theory of natural selection required that this elusive "law" of speciation, or divergence, also be based on the predictable operation of organismic selection. In the light of our contemporary—seemingly—preference for allopatric speciation, Darwin's shift may seem ironic. In the context of *TSoET* and its principal theme of hierarchical selection, Gould stresses the centrality of Darwin's changing views on divergence. After all, so much of what Darwin needed to explain—(1) plenitude in ecology; (2) branching models in phylogeny; (3) the hierarchical structure of taxonomy—rested upon the fact of diversification, not adaptation (see Mayr 1992 on Darwin's several theories of evolution). Darwin, with a possible exception for invoking family or clan selection to explain a hominid's moral traits, doggedly and consistently carried through his program for the exclusivity of organismic selection.

In September 1857 C.E., Darwin wrote his first complete account of the "principle of divergence" in a famous letter to Asa Gray. Gray had explicitly asked Darwin for an epitome of his evolutionary theory, which had been previously revealed only to Darwin's closest confidants, Hooker and Lyell: "It is just such sort of people as I that you have to satisfy and convince and I am a very good subject for you to operate on, as I have no prejudice nor prepossessions in favor of any theory at all," relayed Gray (as cited in Kohn 1981: 1107). Darwin responded positively to Gray with a lucid summary of his theory in six points:

1. The power and effect/efficacy of artificial selection.
2. The even greater power of natural selection working on all characters at once and over vastly longer spans of geologic time.
3. The operation of natural selection at the organismal level, powered by the Malthusian principle that all species produce far more offspring than can possibly survive.
4. A description of how natural selection works in nature, silently scrutinizing every possible opportunity for advancement.
5. A defense of gradualism as the solution to then-standard problems in accepting the factuality of evolution. And,
6. An explication of the principle of divergence.

Darwin's argument about divergence begins with an unquestioned premise that resonates with a central theme of Darwin's century—the clear and inherent "good" of maximizing the amount of life in any given region, and the consequent necessity for a cause to insure this natural "goal." Maximization, Darwin argues, arises by diversification: the more taxa in a given area

(and the more different), the greater the total quantity of life that will result. This promulgation by Darwin has obvious implications for the derivation of sentience, note; this is simply because with the expansion of diverse organ/isms, the chance for natural selection to increase complexity of the entity in question increases. I submit to my reader, as a central tenet of this dissertation, that intensifications of sentience are the necessary and inevitable outcome of this process. In the fullest discussion within *Natural Selection* (his originally intended longer book, which was eventually published in 1975 C.E., but was circumvented by Wallace's letter to him in 1858 C.E.), Darwin firmly links maximization of life to diversification of taxa:

> I consider it as of the utmost importance fully to recognize that the amount of life in any country, and still more that the number of modified descendants from a common parent, will in chief part depend on the amount of diversification which they have undergone, so as best to fill as many and as widely different places as possible in the great scheme of nature. (Darwin 1975, 234)

Nature itself "desires" the maximization of life by diversifying the number of species in each region of the globe, it seems. Darwin explicates and defends the maximization of life with his favorite rhetorical device—analogy—and by invoking another fundamental tenet in the political economy of his era: the division of labor. As taxa specialize ever more precisely to definite and restricted roles in local ecologies, more species can be supported, which leads to a maximum display of life. And, of course, with this maximum display of life comes more opportunities for natural selection to create—and thereafter fill—more individual niches in

nature. One should discern rather easily what this might portend for the derivation of and intensifications of sentience.

In January, 1855 C.E. (in the note that was the genesis of his principle of divergence), Darwin takes this step into the philosophical radicalism of rendering higher harmonies by individual struggle:

> On Theory of Descent, a divergence is implied and I think diversity of structure supporting more life is thus implied… I have been led to this by looking at heath thickly clothed by heather and a fertile meadow both crowded, yet one cannot doubt more life supported in second than in the first; and hence (in part) more animals are supported. This is the final cause but mere result from struggle (I must think out last proposition) (quoted in Schweber 1988, 514).

Note that Darwin's utterly abysmal handwriting has caused endless problems to scholars. All historians recognize the crucial status of this final sentence, referenced in the above paragraph, but each major interpreter reads the line in a different way. For example, Dov Ospovat offers the following: "This is not final cause, but mere results from struggle, (I must think out this last proposition.)" (Ospovat 1981, 180–81). Janet Browne's version reads: "This is not final cause but mere result from struggle (I must think out this last proposition.)" (Browne 1980, 71). And David Kohn offers this rendition: "This is not final cause, but more [a] result from struggle, (I must think out this last proposition.)" (Kohn 1985, 256).

Aside from articles and punctuation, two disagreements about this sentence are rather substantial: (1) did Darwin write "mere" or "more" with respect to struggle?—while "mere"

would be stronger, because then the higher order harmony of ecosystems becomes nothing but a consequence, nevertheless “more” still conveys the same sense, just not as strongly, for higher order maximization of life would still represent more a consequence of individual struggle than anything else; (2) did Darwin say that maximization is not a final cause (Ospovat, Browne, Kohn), or does he choose to view such abundance of life as the final cause of struggle? These different readings seem to suggest a serious discrepancy, but the meaning, I assert, will be much the same in either case. Darwin tells us, one way or the other, that individual struggle provides the generating cause, with maximization of life arising as a consequence. Thus, Darwin argues either that Aristotle’s notion of “final cause” (*telos*) has no place in science (since maximization of life only represents the presence of struggle); or, alternatively, he states that one may continue to use the term “final cause” in an informal sense, as long as he/she acknowledges the underlying mechanism, or efficient cause, producing the phenomenon (i.e., natural selection). In this second case, maximization is a “final cause” as long as one recognizes its origin in struggle, and not in created harmony. Unfortunately, this same terminological ambiguity continues today in evolutionary theory at large: scientists use the language of final cause, or purpose, in describing adaptation, but they do so confusedly, I contend.

Kellogg (1907), as previously mentioned above in the introduction, divided critical commentary about Darwinism into arguments “auxiliary to” and “alternative to” natural selection—enlargements and confutations, one might say. In the past roughly one-hundred and sixty years, critiques of the Darwinian tripod have usually been advocated in Kellogg’s alternative, or destructive, mode—and a tradition for quick (often ill-considered) and defensive

reaction by Darwinians has developed whenever several critical buzz-words rise again: e.g., rapid change, group selection, mass extinction, directed mutation, *et cetera*. But these several critiques can also generate powerful versions in Kellogg's auxiliary, or helpful and expansive, mode.[11] Older versions of these three critiques rightly received rebuke by the advocates of the Modern Synthesis. Indeed, hierarchy (the first leg) foundered in the mysticism of super-organisms and harmonious ecologies; constraint and laws of form (the second leg) became mired in invalid macro-mutationism, or lingering orthogenesis; and catastrophic geology (the third leg) languished in the failure of all proposed mechanisms for global spasmodic change. The old(er) versions of these critiques, freighted by the cultural bias of "progress," and rooted in false arguments for the demise of Darwinism, richly and rightly deserved the rejection they received at the pens of the Modern Synthesis founders, I assert.

Darwin's Solution

Darwin himself may draw together the various threads of this conversation heretofore on variation, gradualism, and adaptation better than anything that I can articulate. Consider the following passage from the *Origin* on why the basic results of evolution and variation teach us so little about the origin of species, and why an understanding of the mechanism of natural selection is necessary as an explanation of adaptation:

> But the mere existence of individual variability and of some few wellmarked varieties, though necessary as the foundation for the work, helps us but little in understanding how species arise in nature. How have all those exquisite adaptations of one part of the

[11] As Kellogg himself recognized when he classified Weismann's theory of hierarchy as one of the two most significant auxiliary propositions of his time.

> organization to another part, and to the conditions of life, and of one distinct organic being to another being, been perfected? We see these beautiful co-adaptations most plainly in the woodpecker and missletoe; and only a little less plainly in the humblest parasite which clings to the hairs of a quadruped or feathers of a bird; in the structure of the beetle which dives through the water; in the plumed seed which is wafted by the gentlest breeze; in short, we see beautiful adaptations everywhere and in every part of the organic world (Darwin 1859, 60–61).

Darwin also writes, “Natural selection tends only to make each organic being as perfect as, or slightly more perfect than, the other inhabitants of the same country with which it has to struggle for existence” (Darwin 1859, 201). We can discern from the preceding quote that Darwin’s universe is drastically different from the one of William Paley (1802), principally with respect to the outcome of what Darwin terms natural selection. However great the power of Darwin’s natural selection mechanism, it cannot be perfection, but only a relative improvement of competitive superiority in local—or present—circumstances. One could say, in fact, that natural selection operates as a principle of “better than,” not as a principle of “best.” Thus, the signs of historical derivation will not be erased; evolutionary entities will forever retain signatures of their past evolution as quirky little oddities and imperfections; that is, they will forever display and ornamentalize their contingent history of derivation. Nothing, it seems, can escape its own history.

Natural selection fashions—or crafts—the organic world, while leaving enough signs of her previous handiwork to reveal a formative presence. Gould calls this “the adaptationist

program," rather than simply "adaptation" because Darwin presents a profound protocol for actual research, not just an abstract conceptual structure (Gould 2002, 157). Consider: adaptation is the central phenomenon of the evolutionary epic, and the key to any understanding of its machinations. This is, roughly, because natural selection crafts adaptation. Further, this is due to the fact that natural selection maintains an overwhelmingly predominant relative frequency as a cause of adaptation. Variation provides raw material, but cannot do the work unaided.

Adaptation is the answer to the problem of transforming external (environmental) information into internal changes of form, physiology and behavior. Darwin at all times grants natural selection the most fundamental and critical role by virtue of its relative frequency—it is "by far the predominant Power" (Darwin 1859, 43; interestingly, this is upper case for emphasis in the original—what was Darwin implying?). Elsewhere, Darwin writes, "Over all other causes of change, I am convinced that Natural Selection is paramount" (Darwin 1975, 223). The best strategy for finding the source of change in populations, Darwin asserts, lies in the study of adaptation, for adaptation is the direct and primary result of natural selection. Moreover, the relative frequency of selection stands so high that almost any adaptation will record its forming power. Adaptation therefore becomes, for Darwin, the primary subject for practical study of evolutionary mechanisms.

Darwin, seemingly, names adaptation as both the common and coordinating result of nearly any episode of non-trivial evolutionary change. So then, adaptation not only pervades nature with overwhelming relative frequency, but it also embodies the immediate action of the primary cause of change, to which applies natural selection. Thus, an evolutionary biologist's (or

a paleontologist's) first approach to any problem regarding change in evolutionary entities must pose the question: what adaptive value can we assign to this feature or adaptation—i.e., how did natural selection work in this instance? In promoting the (near) *Allmacht* of natural selection, Darwin rolls all exceptions, all ifs and buts and maybes, into subsidiaries of adaptation forged by natural selection, meaning that the reality of an entity's situation is either a consequence of adaptation, or inherited marks of previous adaptations.

Thus writes Darwin:

> Hence every detail of structure in every living creature (making some little allowance for the direct action of physical conditions) may be viewed, either as having been of special use to some ancestral form or as being now of special use to the descendants of this form—either directly, or indirectly through the complex laws of growth (Darwin 1859, 200).

So then, in Darwin's argument about the creative potential of natural selection, he expects one to buy into an entire conceptual world—a world where externalities (that is, environments) direct and erect evolutionary entities, and internalities supply only raw material but impose no serious constraint upon or challenge to change. This, then, is a world where the functional stimulus for change comes first and the structural alteration of form only follows. This (near) *Allmacht* creativity of natural selection makes adaptation the central principle, isotropy of variation

necessary to it, and gradualism pervasive within it.[12] But if one (or more) of these three contentions fail, does the whole also fail? Let us look a little closer.

Darwin's Functional Shift and Cooptation

The central principle that there is a fundamental difference between reasons for historical origin and current functional utility—a vital component in all historical analysis, as clearly recognized but insufficiently emphasized by Darwin—has also been unfortunately underplayed (or forgotten) by later acolytes of Darwin. Darwin himself invoked this principle of disconnection between historical origin and current utility both in the *Origin's* first edition (1859), and particularly in later responses to St. George Mivart's critique on the supposed inability of natural selection to explain the incipient (and apparently useless) stages of adaptive structures in the sixth edition of the *Origin* (1872). Darwin asserted that, although incipient stages could not have functioned in the manner of their final form, they might still have arisen by natural selection for a different initial utility (feathers first evolved for thermoregulation and later co-opted for flight, e.g.). Darwin called this process functional shift; he used this principle of cooptation, or functional shift, in two important ways that enriched and expanded his theory

[12] In 1893 C.E., Herbert Spencer published a long critique in the *Contemporary Review* titled, "The Inadequacy of 'Natural Selection.'" In it, he strongly supported the Lamarckian principle of use and disuse with inheritance of acquired characters and, while not denying the importance of Darwin's principle of natural selection, railed against its exclusivity in (macro-)evolution. This exclusivity was claimed for natural selection by August Weismann and his school, variously labelled as "strict," or "ultra" or "neo" Darwinism. Weismann quickly rose to Spencer's challenge, choosing for the title of his rebuttal a German phrase which was somewhat directed to Spencer: *Die Allmacht der Naturzuchtung*—a title rendered by the English translator at the time as "The All-Sufficiency of Natural Selection" (although I would prefer the literal "All-Might"). This exchange became the focal point of the interesting debate between "neo-Darwinism" and "neo-Lamarckism," which was perhaps the hottest subject in evolutionary theory at the end of the nineteenth century. For this point, see Spencer (1893a and 1893b); see also Weismann (1893); for a summation of this important dialogue between Spencer and Weismann, see Kellogg (1907, 134).

away from the caricatured pan-selectionist version of the later August Weismannian variety (to which I once had, and still do at times, sympathies for): (1) as the primary ground of historical contingency in phyletic sequences (for one cannot predict the direction of subsequent cooptation from different primary utilities); and (2) as a source of structural constraint upon evolutionary pathways.

These Darwinian invocations, however, stopped short of a radical claim for frequent and important nonadaptive origins of structures coopted for later utility, which has been a constant source of latency for the derivation of sentience. That is, Darwin rarely proceeded beyond the principle of originally adaptive origin for different function, with later cooptation for altered utility. In fact, this idea did not have a proper name in evolutionary theory until Gould and Elizabeth Vrba (1982) referred to it by the moniker of "exaptation"; rather, it did not have a proper scientific name, for it was until then referred to as a "preadaptation," which invariably raised eyebrows amongst diehard Darwinians (in part because the very formulation of "pre"-adaptation invokes some sort of teleology). Exaptation of structures that arose for different adaptive reasons remains within a broadened conception of selectionist orthodoxy (while granting structural constraint a large influence over historical pathways, in contrast with crude pan-adaptationism), however, by confirming a Darwinian basis for the adaptive origin of structures, whatever their later history of exaptive shift. So then, Darwin's theory, in strong and revolutionary contrast to former evolutionary thinking, presents the first truly "externalist" account of evolution, in which contingent change (the summation of unpredictable local adaptations rather than a deterministic unfolding of inherent potential under internal, biological

principles) proceeds by an interaction between organic raw material (isotropic variation) and environmental guidance (natural selection). Darwin overturned all previous traditions by thus granting the external environment a causal and in fact *controlling* role in the direction of evolutionary change (with "environment" construed as the ensemble of biotic and abiotic factors, external to the organism, however intrinsically locked unto, or even largely defined by, the presence of the organism itself).

Adaptational results flow, then, logically from the mechanisms defining all other sub-branches on the limb of Darwinism designated by Gould as the "creativity of natural selection" (Gould 2002, 155). If the uniqueness and revolutionary character of Darwinism inheres largely in the formulation of natural selection as a theory of interaction between biological insides and environmental outsides—and not as a theory of *evolutio*, or intrinsic unfolding—then the "outsides" must receive explicit discussion as well, a need best fulfilled within Darwin's case for the full extrapolation of natural selection. Under strict internalist theories of evolution, environment, however—at most—holds power to derail the process by not behaving properly. Ironically, such internalist theories follow the literal meaning of "evolution" (that is, unfolding) far better than the Darwinian system that eventually absorbed the term. Darwin understood this etymological point well, and he therefore declined to use the word "evolution" at first, preferring instead, "descent with modification"—probably because he recognized the difference between the literal meaning of "evolution" and his own concept of life's history as creative change by natural selection.

Gould argues that some degree of "internalism" poses two separate challenges to pure Darwinian functionalism: (1) saltational change arises from internal forces of mutability; and (2) the inherent directionality of variation (corresponding to facet-flipping and channeling on Galton's polyhedron, which will be discussed later in this dissertation). Most internalists (or structuralists, or formalists) emphasize the second theme of channels and preferred directionality of variation (now expressed in the popularity of "constraints" as a subject in [late-]modern evolutionary literature). This style of internalism predominates also throughout history; fewer internalists emphasize the saltational theme—and those who do, like William Bateson—tend to support channeling as well as facet-flipping (the two themes fuse well into a coherent anti-Darwinian philosophy, as Bateson recognized and articulated). In contrast, under Darwinian functionalism, environment becomes an active partner in both the modes and directions of evolutionary change. The central logic of Darwinism is based upon two essential biological postulates of natural selection—its operation at the organismal level, and its creativity in crafting adaptations. The evolutionary epic (or play) can proceed with such a minimal cast, but we do not know whether the drama can actually unfold (*evolutio*) on our planet until we also examine (and specify) the character of the proverbial evolutionary theater—that is, the geological and environmental stage upon which the play of natural selection is run.

Gould's Solution for Darwin's Solution

Gould avers that the key questions in the twenty-first century regarding biology and evolution, particularly (macro-)evolution, include at least the following: Shall we accept Darwin's triumphalist stance and hold that the framework remains basically fixed, with all

visually substantial change analogous to the non-structural, and literally superficial, icing of pinnacles? Or shall we embrace Falconer's richer and more critical, but still fully positive, concept of a structure that has changed in radical ways by incorporating entirely different styles into crucial parts of the proverbial building, while still managing to integrate all the differences into a coherent and functional whole, encompassing more and more territory in its continuing enlargement (Gould 2002, 5–6)? After all, for Gould, the distinction between Falconer's and Darwin's predictions, a key ingredient in my analysis, rests upon one's ability to define the central features of Darwinism (its "autapomorphies," as Gould calls them),[13] so that we may then discern whether the extent of alteration in our contemporary understanding of evolutionary mechanisms and causes remains within the central logic of this Darwinian foundation, or whether it has now changed so profoundly that—by any fair criterion in vernacular understanding of language, or by any more formal account of departure from original premises—our current explanatory theory must be described as a different kind of mental "thing"? I personally think the latter is true.

Shared content, not only historical continuity, must define the structure of a scientific theory (in this case, [macro-]evolutionary theory); but this shared content should be expressed as a minimal list of the few defining attributes of the theory's central logic—in other words, only the absolutely essential statements, absent which the theory would either collapse into fallacy or

[13] Autapomorphies (from *auto-*, "self") are features derived in individual taxa (a group that is represented by a single terminal in a given phylogenetic analysis). Autapomorphies express nothing about relationships among groups; clades are identified (or defined) by synapomorphies (from *syn-*, "together"). Clades are also known as a monophyletic group (natural group) of organisms, meaning that they are derived from a common ancestor, and share lineal descendants.

operate so differently that the mechanism would have to be granted another name. Gould attempts to construct an "essence" of (macro-)evolutionary theory within *TSoET* (say it with me: essence, essence, essence!). According to Gould, indeed, theories have essences. (So do organisms, in a more restrictive and nuanced sense, I might add—in their limitation and channeling by constraints of structure and history, expressed as *Bauplan* of higher taxa). Moreover, Gould's partial defense of organic essences, expressed as support for structuralist versions of evolutionary causality as potential partners with the more conventional Darwinian functionalism that denies intelligibility to any notion of an essence, also underlies the double entendre of *TSoET's* title, which honors the intellectual structure of evolutionary theory within Darwinian traditions and their alternatives, and which also urges support for a limited version of structuralist theory, in opposition to certain strict Darwinian varieties. The massive switch from archetype to ancestor in (macro-)evolutionary theory, permitted one to reformulate the idea of "essence" as broad and fruitful commonalities that unite a set of particulars into the most meaningful relationships of common causal structure and genesis. The active use of the "good word" essence, Gould strongly asserts, should not be hampered by a shyness due to battles won so long ago that no one can remember the original reasons for the anathematization of "essence" (Gould 2002, 11).

Gould, indeed, shows that this formulation of Darwinian minimal commitments proves its mettle on the most vital ground of "maximal utility." For not only do these three commitments build, in their ensemble, the full frame of a comprehensive evolutionary worldview, but they have also defined the chief objections and alternatives motivating all the

most interesting debate within evolutionary theory during its initial codification in the nineteenth-century. Moreover, and continuing into the twenty-first century, these three themes (agency, efficacy, and scope) continue to specify the major weaknesses—the places in need of expansion or of shoring up—and the locus of unresolved issues that make evolutionary biology such a central and exciting subject within the ever changing and ever-expanding world of (late-)modern evolutionary theory (Gould 2002, 11–12). Thus, it is part of Gould's goals to formulate an expanded explicitly (macro-)evolutionary theory that introduces substantial revisions on each branch of Darwinian central logic, but builds, in its ensemble, a coherently enlarged structure with a retained Darwinian base (alike unto the Duomo of Milan)—moving from Darwin's single level of agency to a hierarchical theory of selection on the first branch; balancing positive sources of internal constraint (for both structural and historical reasons) with the conventional externalism of natural selection on the second branch; and recognizing the disparate inputs of various tiers of time, rather than trying to explain all phylogenetic mechanics by uniformitarian extrapolation from (micro-)evolutionary processes, on the third branch (Gould 2002, 48–49).

Gould's Positions Simplified

Exaptations and Spandrels Promulgated

Many stark and disparate reasons underlie Gould's explicit recognition, during the late 1970s and early 1980s, of the importance and theoretical interest in nonadaptationist themes rooted in structural and historical constraint. First, he stood under the dome of San Marco during a meeting in Venice and then wrote a notorious paper with Richard Lewontin on the subject of "spandrels," or nonadaptive sequelae based on prior structural decisions (Gould and Lewontin

1979). Second, he recognized—with Elisabeth Vrba (Gould and Vrba 1982, 4–15)—that the lexicon of evolutionary biology possessed no term for the evidently important phenomenon of structures coopted for utility from different sources of origin, and not directly built as adaptations for their current function; they therefore devised the term "exaptation" and explored its implications for structuralist revisions to pure Darwinian functionalism.[14] Gould argues for the theme of structural constraint in the fully historicist and phyletic context of aptive[15] evolution by cooptation of structures already present for other reasons (often nonadaptive in their origin), rather than by direct adaptation for current function via natural selection.

The radical version of structural constraint in historicist evolution posits an important role for an additional phenomenon in (macro-)evolution: the truly nonadaptive origin of structures that may later be exapted for subsequent utility. Many sources of such nonadaptive origin may be specified, but inevitable architectural consequences of other features—the "spandrels" of Gould and Lewontin's terminology (1979)—probably rank as the most frequent and most important in the history of lineages. Spandrels (although unnamed) have long been acknowledged in Darwinian traditions, but relegated to insignificant relative frequencies by invalid arguments for their rarity, their structural inconsequentiality (the mold marks on an old bottle, e.g.), or their temporally subsequent status as sequalae—with the first two claims being empirically false, and the last claim logically false as a further confusion between historical origin and current utility.

[14] A classic example of an exapted spandrel is how the structural requirements of a dome necessitate a triangular formation when it is joined to the regular structure of a cathedral. These "pendentives," as they are more accurately called, are used thereafter to create stunning murals, as in the classic Catholic cathedrals of the East.

[15] Note that this term, aptation, was coined by Gould and Vrba (1982) to designate and include both adaptations and exaptations under one proverbial umbrella.

Gould also affirms the importance and high relative frequency of spandrels, and therefore the non-adaptive origin of many characteristics in evolutionary entities within the evolutionary play, by two major arguments for their ubiquity: first for intrinsic structural reasons, the number of potential spandrels greatly increases as organisms and their traits become more complex; e.g., the spandrels of the hominid brain greatly outnumber the immediately adaptive reasons for the increase in brain size; the spandrels of the cylindrical umbilical space of a gastropod shell, by contrast, may be far more limited, although nonetheless exaptively used as a brooding chamber (Gould 2002, 86). To this asserted increase in potential spandrels, as well as the assertion that complexity increases (by Gould), I add that this necessarily results in more sentience (in truth, I would even argue that sentience itself is a spandrel of increasing size and complexity of the brain, but that is another topic for another time and book—not this dissertation). Second, under hierarchical models of selection, features evolved for any reason at one level thereafter generate automatic consequences at other levels—and these consequences are classified as cross-level spandrels (since they are "injected into" the new level, rather than actively evolved there). Gould stipulates that the concept of cross-level spandrels vastly increases the range, power and importance of non-adaptation in evolution, and also unites the two central themes of *TSoET* by showing how the hierarchically expanded notion of selection also implies a greatly increased scope for non-adaptive structural constraint as an important factor in the potentiation of (macro-)evolution (Gould 2002, 88).

Exaptations, Spandrels, and Evolvability

The full classification of spandrels and modes of exaptation offers a nice taxonomy and

solution—primarily through the key concept of the “exaptive pool”—for the compelling problem of evolvability (see Kirschner and Gerhart 1998, 8420–27, and references therein, for further information on flexibility and evolvability). Most evolutionary entities’ intricate adaptations to their environment cannot be understood as wonders of optimal design by natural selection, specially constructed for their current utility(ies), for they represent contraptions, jury-rigged together from the available parts of the exaptive pool.[16] If a capacity for utilization in highly different ways did not lie within the inherent (or formal) structure of most adaptations, then evolution would never be able to reach a novel “there” from its present “here”—and life’s history would lay idle in transient perfection (and then consummately and completely expire when surrounding environments underwent their occasional substantial alterations through cataclysmic events).

After all, natural selection cannot act as a “magic wand” for the immediate construction of a response to any urgent need. Rather, the adaptability—or, the “evolvability”—of any phenotype must depend on a flexibility for future change that simply cannot arise by direct natural selection at the usual Darwinian level of the organism. Thus, a large component of evolvability is attributable to inherent structural properties of features that originated by natural selection for one reason, but also manifest a capacity for subsequent recruitment to substantially different and novel functions. This is why I refer to such as “exapted spandrels.” Gould

[16] Confusion about this concept has centered upon the apparent paradox that ordinary organismal selection—the canonical mechanism of evolutionary change—would seem (at least in effect) to restrict and limit future possibilities by specializing forms to complexities of immediate environments, and therefore to act against an evolvability that largely defines the future (macro-)evolutionary prospects of any lineage. The solution to ameliorate this confusion lies in recognizing that spandrels, as well as all other exaptive potentials, define the ground of evolvability, and play as important a role in (macro-)evolutionary potential as conventional adaptation does for the immediacy of (micro-)evolutionary success.

forthrightly writes, epitomizing the meaning of this theme for the general subject of constraint as a structural channeler of adaptation, that “Exaptive possibilities define the ‘internal’ contribution that organisms make to their own evolutionary future” (Gould and Vrba 1982, 13).[17]

Contingency, Historical Utility, and the Wonderful Life

Toward the end of the twentieth century, Gould published *Wonderful Life: The Burgess Shale and the Nature of History* (1989c), perhaps the most successful book on a paleontological subject since Darwin’s *Origin* (1859). Although seemingly only a historical account of the discovery of the Burgess Shale invertebrates, which are found high in the Canadian Rockies, Gould uses the book to advance a number of claims about the very nature of evolution. According to Gould, Charles Doolittle Walcott (grossly) misinterpreted the fossils that he found in the Burgess Shale in 1909 C.E., due in large part because of his conventional view of life that insisted that evolution was marked by a steady, progressional rise of complexity. *Wonderful Life* (1989c) promotes the notion that Walcott committed a cardinal error by “shoehorning” the Burgess Shale fauna into existing phyla and classes (Gould 1989c, 108). Walcott’s interpretations of the Burgess fossils remained uncontested for more than fifty-years until a group, spearheaded by Harry Whittington at Cambridge University in 1971 C.E., published a monograph that not only reexamined Walcott’s conclusions, but also radically reinterpreted the Burgess Shale fauna, and with it the view of life, even our own evolution. *Wonderful Life*

[17] In fact, Gould everywhere emphasizes the centrality of the exaptive pool for solving the problem of evolvability by presenting a full taxonomy of categories for the exaptive pool’s richness, focusing primarily on a distinction between inherent potentials of structures evolved for other adaptive roles (that is, the classical Darwinian functional shifts that do not depart from adaptationism), and true non-adaptations, arising from several sources, with spandrels as a primary category, and then available for later cooptation from the exaptive pool.

(1989c) recounts the reinterpretation of the Burgess Shale fossils, and of the ideas that emerged from this work by Whittington's group. Three paleontologists dominate the center stage in *Wonderful Life* (1989c), as they did the bulk of the technical work in anatomical description and taxonomic placement of the fauna found therein: the aforementioned Harry Whittington, the world's leading expert on trilobites, and two men who began their careers as his understudies and then built their careers on the Burgess fossils—Derek E. G. Briggs and (important for my own argument in this dissertation) Simon Conway Morris.

Gould employs the fossils of the Burgess Shale in furtherance of his arguments for the importance of historical contingency relative to natural selection and adaptation in the history of life. Indeed, in *Wonderful Life* (1989c), Gould makes three primary arguments. First, rather than the "cone of increasing diversity"—which he indicates is the primary iconography of evolution—the fauna of the Burgess Shale support a model of rapid increase in morphologic disparity, a Christmas tree pattern (i.e., the inverse of most evolutionary paradigms that depict an increasing cone of diversity), followed by elimination of many lineages and diversification of the successful lineages. He thus also claims that the morphologic disparity apparent in the Burgess Shale was a primary feature of the Cambrian explosion, and not a consequence of the subsequent evolutionary history (Gould 1989c, 38).[18] Gould claims that the familiar accounts of evolution are meant to reinforce a comfortable view of human inevitability and superiority, arrived at after a "ladder of progress." However, he contends, "Life is a copiously branching bush, continually

[18] For the general Christmas tree pattern, see Raup et al. 1973, 525–42; Raup and Gould 1974, 305–22; Gould et al. 1977, 23-40; and Gould et al. 1987, 1437–41. We may interpret this bottom-heavy pattern in many ways; Gould sees it as "early experimentation and later standardization" (Gould 1989e, 304).

pruned by the grim reaper of extinction, not a ladder of predictable progress" (Gould 1989c, 35). I will come back to the notion of "progress" in (macro-)evolution in the next chapter of this book. But nevertheless, in Gould's ("mid"-life, at least) view, evolutionary innovation was primarily focused in the events of the Cambrian, with later history largely "generating endless variants upon a few surviving models" (Gould 1989c, 47). He refers to this pattern as "decimation," because he can combine the literal and vernacular senses of the term to suggest the two cardinal aspects stressed throughout *Wonderful Life* (1989c): the largely random (or "chancy") sources of survival or death, and the extremely high probability of extinction.

With regard to randomness in extinction events, the term "decimate" comes from the Latin *decimare*: "to take one in ten"—which referred originally to the standard punishment for members of the Roman army who were found guilty of mutiny: one soldier out of every ten was selected by lot and put to death randomly. With regard to the probability of extinction, Gould points out that decimate connotes how most—say, 90% (but the number is actually much higher than even that)—of the individual entities in the Burgess fauna were extinguished without leaving any significant lineage. Stereotypy—the cramming of most species into a few anatomical plans—is the mark of modern life forms (Gould 1989c, 49).

According to Gould, the history of life is not progressive, necessarily, and it is certainly not predictable. The earth's biota has evolved through a series of fortuitous events. Homo sapiens *sapiens*, for example, did not appear on the earth in one glorious moment of time; "modern" humans arose, rather, as a contingent outcome of thousands of linked events, any one of which could have occurred differently and thereby led evolutionary history on a pathway that

possibly could not have led to the derivation of sentience. To mention just four examples among many:

1. If a member of our chordate phylum, *Pikaia*—which shows its relation to “humans” by its possession of a notochord—had not been among the survivors of the initial radiation of multicellular animal life in the Cambrian explosion ca. 520 MyA, then it is unlikely that vertebrates would have inhabited the earth at all;
2. If a small group of lobe-finned fishes had not evolved with a radically different limb skeleton, with a strong central axis perpendicular to the body, capable of bearing weight on land thereby, then vertebrates possibly would never have become terrestrial;
3. If a meteorite had not struck the earth ca. 65 MyA, then dinosaurs would probably still be dominant today and mammals would still be small creatures living within the dinosaurs’ world; and
4. If a small lineage of primates had not evolved upright posture on the African savannas just two million years ago, then our ancestry might have wound up as a line of ecologically marginal apes (Gould 1989c, 3).

We modern “humans” are, in Gould’s eyes, an item of evolutionary history, and not an embodiment of general evolutionary principles—and thus, sentience itself is a mere happenstance, an evolutionary one-off, so to speak. Or is it? I’ll come back to this question in chapter 4.

Gould suspects that in the great majority of cases, the traits that enhance survival during an extinction event do so incidentally, and are not related to the causes of their evolution in the

first instance. While animals evolve their sizes, shapes, and morphologies under natural selection during normal times and for specific reasons, when a mass extinction comes along, what may have been advantageous before could turn out to be deleterious afterward, whereas a trait without particular significance before the mass extinction event might attain one afterward. He asserts that there can be no causal correlation in principle between the derivation of a trait and its new usage. After all, a species "cannot evolve structures with a view to their potential usefulness millions of years down the road—unless our general ideas about causality are markedly awry, and the future can control the present" (Gould 1989c, 307). Whereas I agree with the general thrust of Gould's statement quoted directly above, at least with regard to biology, I do not about his added-on statement of causality. Instead, I argue that—in a sense—indeed does God's involvement through luring the world forward "influence" the course of history, but I do not argue that the future necessarily "controls the past." I argue, instead, that God's amorepotent and uncontrolling love allows entities much freedom, as long as the levels of sentience are steadily increased.

The model of maximal increase in morphologic disparity early in the history of Metazoa as a whole leads to the second major argument of *Wonderful Life* (1989c), which is Gould's thought experiment of replaying the tape of life over again. The Burgess pattern of decimation shows that groups may prevail or die for reasons that are not related (at all…) to Darwinian selection processes. This leads him to stipulate that if it were possible to "replay the tape" of evolution, the outcome would almost certainly be very different, both in detail and in general—e.g., there might not be any sentient species at all. Gould's argument in *Wonderful Life* (1989c)

represents the culmination of his fight against overly adaptive storytelling and inferred evolutionary progress:

> Any replay of the tape would lead evolution down a pathway radically different from the road actually taken. But the consequent differences in outcome do not imply that evolution is senseless, and without meaningful pattern; the divergent route of the replay would be just as interpretable, just as explainable *after* the fact, as the actual road. But the diversity of possible itineraries does demonstrate that eventual results cannot be predicted at the outset. Each step proceeds for cause, but no finale can be specified at the start and none would even occur a second time in the same way, because any pathway proceeds through thousands of improbable stages. Alter any early event, ever so slightly and without apparent importance at the time, and evolution cascades into a radically different channel (Gould 1989c, 51).

For Gould, this is the essence of contingency. Occurrences in the history of (macro-)evolution *just happened*—they were not necessary, certainly not predictable, and every one of them could have been different. In fact, a number of other possible events may have happened in their stead. Importantly, Gould is keen to highlight that each event has its own cause, but these causes were not necessary. Gould's third argument in *Wonderful Life* (1989c) builds from the pattern of disparity and the importance of contingency to conclude that natural selection and adaptation play a *less* significant role in evolution than acknowledged by most evolutionary biologists.

We biologists and paleontologists do not know why most of the early experiments were failures, with only a few surviving to become modern *phyla*. It is tempting to say that the victors won by virtue of greater complexity, better fitness or some other predictable feature of the conventional Darwinian struggle. But nothing in particular unites the victors, and a radical alternative must be, therefore, considered. That is, that each early experiment received little more than a proverbial ticket in the largest "lottery" ever played on our planet—and that the surviving lineages, including our own phylum of vertebrates, survived more by the luck of the draw, as in a lottery, than by any intrinsic merit.

The transforming power of the Burgess message can be seen in its affirmation of "history" as the chief determinant of life's direction, and it shows that the fantastic explosion of early disparity is followed by decimation, largely based in terms of what can be pictured as a lottery. While the laws of nature impact the general forms and functions of organisms, the channels are so broad that the details are left to chance. The physical channels do not specify "arthropods, annelids, mollusks, and vertebrates, but, at most, bilaterally symmetrical organisms based on repeated parts" (Gould 1989c, 290). In fact, Gould states, "I suspect that given the composition of early atmospheres and oceans, life's origin was a chemical necessity. Contingency arises later, when historical origin enters the picture of evolution" (Gould 1989c, 309).

Contingency gains its greatest force through the principle of "quirky" functional shift: i.e., the discordance between historical origin and current utility, and the consequent fallacy of direct inference from (late-)modern status to initial function. This quirky historical character of

major evolutionary change in particular lineages—thoroughly explainable after the fact, however unpredictable in principle beforehand—constitutes one of the greatest fascinations of evolutionary biology. Yet, this same inherent historicity has saddened and maddened scientists of other temperaments and predilections. For people who find greatest satisfaction in those aspects of nature that achieve full meaning and explanation under invariant and timeless laws, but who cannot resist the fascination of evolutionary biology, the irreducibly contingent aspect of (macro-)evolution defines its least congenial attribute. Such scientists have therefore tended to underplay contingency, or to focus on those broader aspects of the subject—far from the fascinations of real history in concrete lineages—that do fall into the more conventional realm of predictability under natural law (Gould 2002, 1227). Spandrelists, then, generally share the evolutionary biologist's traditional fascination for contingent details of history in individual lineages under study. Spandrels indeed express general and predictable properties, but they originate as necessary consequences of particular triggers that can only be understood in a contingent historical and phylogenetic context. This class of non-adaptive origins challenges the dominant role of pan-adaptationism, particularly of the "*Allmacht*" August Weismann (1893) variety, a tendency that I once (still, at times?) adhered unto in (macro-)evolutionary theory.

Agency, Efficacy, Scope, and the Hegelian Triad

Now, in the twenty-first century, however, forms of these critiques are being advanced in different and helpful versions within Kellogg's (1907) auxiliary mode—i.e., as ideas to expand, while substantially changing, the Darwinian core. For the first leg of the triad, agency, the hierarchical theory of multi-level selection retains Darwin's emphasis on the centrality of

selection as a mechanism, but rejects the notion that the organismal level must hold nearly exclusive sway as a causal locus of change. Indeed, the theory of hierarchical selection differs substantially from classical Darwinism in basic logic and concept. This is because explanations of both stability and change must now be framed as compound results of a balanced interaction of levels, working in concert, in conflict, or orthogonally, and not as shifting optimalities built at a single level.

On the second leg of efficacy, contemporary ideas of constraint and channeling deny the crucial emphasis on the isotropy of variation, so necessary to the logic of selection as the primary directional force in evolution. These contemporary ideas therefore envision important roles for structural and internal causes as patterning "agents" of (macro-)evolutionary change. So then, these internal channels work with selection as conduits for its impetus—i.e., as auxiliary (not alternative) forces to natural selection. Further, on this second leg, an emphasis on constraints and channels implies a new set of operational concerns: i.e., internally imposed biases upon directions of change become a major subject for study. Thus the role of developmental patterns, strikingly, are again becoming prominent in (macro-)evolutionary theory.

For the third leg of extrapolation, current notions of mass extinction do not challenge the Darwinian mechanism of selection *per se*, but do suggest that any full explanation of (macro-)evolutionary pattern must integrate the accumulated Darwinian effects of normal times with the profound restructurings of diversity that occur in environmental episodes too rapid, or too intense, for adaptive response by many species and clades. On the third leg, moreover, a renewed appreciation for the shaping power of mass extinction reinstates paleontology as a *source* of

theory, and not merely a repository for the historical unfolding of processes fully illuminated by (micro-)evolutionary studies. The "new" theory developed by Gould (1982a) may remain Darwinian in spirit, that is, a "higher Darwinism," but its development requires a wrenching from several key assumptions of classical Darwinism—not simply a smooth evolution from conventional precepts. This "difference" is embodied in both the tripod of essential theoretical support, and the methodology of uniformitarian extrapolation (the theoretical and methodological poles of Darwinism). Substantial change in any domain usually follows such a scenario, and cannot unfold in smooth and untroubled gradualistic continuity.

The venerable Hegelian triad of thesis—antithesis—synthesis may not adequately describe all examples of important change, but this classic philosophical model of tension and (often) episodic resolution seems more in tune with nature. Or, at least, it is higher in relative frequency among patterns of change. In contemporary versions of the three critiques, classical Darwinism either becomes expanded, or dynamically counterposed with other causal forces working in concert with selection to produce the patterns and pageant of life's history. This dynamic counter-position with orthogonal forces working in concert with selection, occurs either: (1) at a conventional (micro-)evolutionary scale (i.e., internal channels as conduits for selection); or, (2) as interacting regimes through geological time (i.e., mass extinctions and selective replacements).

The second round of Synthesis-making in the mid-twentieth century was pursued in an entirely different and more "fruitful" manner than the nineteenth-century debates. Indeed, the earlier questioning of Darwin's three central principles tried to disprove natural selection by

offering alternative theories based on confutations of the three items of central logic. The contemporary versions, in contrast, accept the validity of the central Darwinian logic as a foundation, and introduce their critiques as helpful auxiliaries (a 'la Kellogg 1907) or additions that enrich—or substantially alter—the original Darwinian formulation, but that leave the kernel of natural selection intact. Thus, the contemporary reformulations are constructive rather than destructive. For this reason, Gould regards our (late-)modern understanding of evolutionary theory as closer to Falconer's metaphor, than to Darwin's—i.e., a structure with a firm foundation and a fascinatingly different superstructure. Or, one could say, akin to the Duomo of Milan.

Roles of Mass Extinction, Hierarchy and the Tiers of Change

On the third branch of extrapolation, the discovery and relatively quick validation, beginning in 1980 C.E., of a truly catastrophic trigger for at least one great mass extinction (cf. the K-T event, ca. 65 MyA), fractured the uniformitarian consensus. This uniformitarian consensus, of course, was embraced by a century of paleontological complacency, which allowed the postulation that all apparent faunal overturns could be "spread out" into sufficient time for explanation by ordinary causes under plausible intensifications that would not alter conventional modes of evolution and extinction. Gould's (late-)modern revision seeks to replace: (1) Darwin's unifocal theory of organismic selection with a hierarchical account (leg one); (2) Darwin's unidirectional theory of adaptational construction in the functionalist mode with a more balanced interaction of these external causes, treating thereby internal (or structural) constraints primarily as positive channels, and not merely as limitations (leg two); and (3) Darwin's unilevel

theory of (micro-)evolutionary extrapolation with a model of distinctive but interacting modes of change, each characteristic for its tier of time (leg three). In short, it seeks to replace: (1) a hierarchy of interacting levels, each important in a distinctive way, for Darwin's single locus of the organism; (2) an interaction of environmental outsides with organic insides for Darwin's single direction of causal flow; and (3) a set of distinctive temporal tiers for Darwin's attempt to situate all causality in the single (micro-)evolutionary world of our own time. There is a common underlying vision behind all these proposed reforms by Gould: i.e., strict Darwinism—although triumphant within mid-twentieth century (macro-)evolutionary theory—embodied several broad commitments (philosophical and metatheoretical), more characteristic of nineteenth- than of twentieth-century (-plus) thought.

Gould on Punctuated Equilibrium

Punctuated equilibrium bestows a special importance to speciation as a major cause of morphological evolution. The remaining history of a species is regarded as a latent—or even dormant—period, as the species has a homeostatic mechanism that resists change internally. Trends in evolution are therefore variations in speciation and extinction rates, which means further that phyletic evolution alone is therefore an incomplete explanation of (macro-)evolutionary trends. Gould sees the theory of punctuated equilibrium as the cornerstone of his larger hierarchical theory of evolution.

I'd like to start this coverage of "punk eek" by going backwards to the beginning of it, and in fact make a summary of what punctuated equilibrium is set against. In the more commonly advocated (and, frankly, better supported) phyletic gradualism, most evolutionary

change arises by gradual transformation of entire species populations. This process of gradual transformation is mediated through and by natural selection, it is evenly distributed in the natural world, as well as being quite “slow” in real-time. Morphological evolution, in such a model, is thus a product of gradual change within populations of interbreeding entities (or, “clades”). Contrast the above process with punctuated equilibrium which considers speciation as the time when most evolutionary change occurs. In this latter model, during the rest of a species’ history, change is minute, or at least without an obvious trend. Speciation, in this latter model, then, is the main cause of morphological evolution. Although speciation may not always involve morphological change, the punctuated equilibrium model implies that speciation sets the tempo (and thereby necessarily the mode) of morphological evolution.

Moving into Eldredge and Gould’s specific contributions to punctuated equilibrium, I will state that Eldredge and Gould began their original article (1972) on it with a philosophical discussion—based on the works of Thomas S. Kuhn’s *The Structure of Scientific Revolutions* (1962) and Norwood R. Hanson’s *Patterns of Discovery* (1962)—on the necessary intermingling of fact and theory. Eldredge and Gould ended the introductory section of this essay by writing,

> The inductivist view forces us into a vicious circle. A theory often compels us to see the world in its light and support. Yet we think we see objectively and therefore interpret each new datum as an independent confirmation of our theory. Although our theory may be wrong, we cannot confute it. To extract ourselves from this dilemma, we must bring in a more adequate theory; it will not arise from facts collected in the old way… Science progresses more by the introduction of new world-views or “pictures” than by the steady

> accumulation of information… We believe that an inadequate picture has been guiding our thoughts on speciation for 100 years. We hold that its influence has been all the more tenacious because paleontologists, in claiming that they see objectively, have not recognized its guiding sway. We contend that a notion developed elsewhere, the theory of allopatric speciation, supplies a more satisfactory picture for the ordering of paleontological data (1972, 86).

Neither Gould nor Eldredge have ever viewed punctuated equilibrium, which does refute Darwinian gradualism in the sense of a geological claim for slowness and smoothness, as an attack on the creativity of natural selection itself (see, e.g., Eldredge and Gould 1972, 82–115; Gould and Eldredge 1977; and Gould and Eldredge 1993). The challenge of punctuated equilibrium to natural selection rests not upon the notion of gradualism, *per se*, but upon two entirely different issues of support provided by punctuational geometry for the explanation of cladal trends: (1) it does this by differential species success and not by extrapolated anagenesis; and (2) it does this by the high relative frequency of species selection, as opposed to the exclusivity of Darwinian selection on organisms. In other words, punctuated equilibrium makes its major contribution to evolutionary theory, not by revising (micro-)evolutionary mechanics, but by individuating species and thereby establishing the basis for an independent theoretical domain of (macro-)evolution.

As Eldredge and Gould devised punctuated equilibrium, Gould resolved these two puzzles to his satisfaction, and each resolution, when generalized and further developed, led to Gould’s two major critiques of the first two branches of the essential triad of Darwinian central

logic presented in *TSoET* (i.e., the "agency" and "efficacy" of natural selection). The identification of punctuated equilibrium as central to Gould's theoretical world is apt, but it is more-so a starting point than a coordinating focus. By accepting the geologically abrupt appearance and subsequent extended stasis of species as a fair description of an evolutionary reality, and not only as a sign of the poverty of paleontological data, Eldredge and Gould (1972) recognized that species met all criteria for definition and operation as genuine Darwinian individuals in the higher-level domain of (macro-)evolution. This insight led them to the concept of species selection in particular and, eventually, to the full hierarchical model of selection as a theoretical challenge and contrast to Darwinian convictions about the exclusivity of organismal selection.

Furthermore, punctuational rather than "continuationist" models of change (with stronger structuralist components grounding the punctuational versions) emerge as the most prominent and most interesting conclusions for Gould from his reading of paleontological data (Gould 2002, 32). Darwinian functionalist mechanics yield an expectation of continuously improving local adaptation, with long-term stability (stasis) representing the achievement of an optimal state. But interactionist and multi-leveled models of causality reconceptualize stasis as a balance, actively maintained among potentially competing forces at numerous levels, with the change in the system then regarded: (1) as exceptional rather than incipiently ticking most of the time; and (2) punctuational in orientation rather than gradual. As a result, a structural and descriptive hierarchy of equally effective causal levels undermines a more conventional hierarchy of relative importance rooted in Darwin's exclusive emphasis on the (micro-)evolutionary mechanics of

organismal selection. Thus, this structuralist view of nature's order actually enriches the structure of evolutionary theory. It does this, for example, by carrying the difference between strict Darwinism and our current understanding through more than enough metatheoretical space to fashion a Falconerian, not a strictly Darwinian, rebuilding and extension for the edifice of coherent explanation (Gould 2002, 33).

Punctuated equilibrium, however, took a radically different approach by admitting unresolvability under the stated assumptions. It then also, however, denied the focal empirical premise that new species usually (even often) arise by gradualistic anagenesis. Instead, Eldredge and Gould (1972) argue that the vast majority of species originate by splitting. Thus, they claim, that the standard tempo of speciation, when expressed in geological time, features origination in a proverbial geological "moment" followed by long persistence in stasis. So then, for the tempo of evolution, punctuated equilibrium reverses the basic evolutionary perspective. Eldredge and Gould (1972) contend that contemporary biologists must abandon their concept of constant change operating within a sensible, stately range of rates as the "normal" condition of an evolving entity.

We biologists must, therefore, reformulate evolutionary change as a set of rare episodes, short in duration relative to periods of stasis between. Stasis (or stability) is the "normal" state of a lineage, with change needed to be recast as an infrequent and concentrated event that, nonetheless, renders phylogeny as a set of summed episodes through time. The implications of this fundamental shift resonate afar by impacting a set of issues: e.g., in an implication immediately relevant to biology, the shift places much greater emphasis upon chance and

contingency, rather than predictability by extrapolation—for the ordinary condition of stasis provides little insight into when and how the next punctuation will occur. However, the character of gradualism suggests that causes of change at any moment will, by extrapolation, both predict and explain the larger effects accumulated through longer times. On the practical side, punctuated equilibrium's formulation of tempo has validated the study of stasis—which is paleontology's prevalent pattern within species—as a source of insight about evolution, rather than a cause of silence about the supposed "nothing" of stasis. As a result, punctuated equilibrium suggests novel, and irreducibly (macro-)evolutionary, explanations for both phenomena: i.e., the role of punctuated equilibrium in establishing an independent field of (macro-)evolution is that it uncouples (macro-) from (micro-)evolution as a descriptive necessity, while not establishing independent causal principles of (macro-)evolution.

Contemporary biologists must, then, reformulate evolutionary change as a set of rare episodes, short in duration relative to periods of stasis between. Stability will then become the normal state of a lineage, with change recast as an infrequent and concentrated event that, nonetheless, renders phylogeny as a set of summed episodes through time. Thus, the classic and endlessly discussed "species problem in paleontology" disappears because species act as well-defined Darwinian individuals, not as arbitrary subdivisions of a continuum. Species themselves then gain definability because they almost always arise by speciation due to splitting, or geographic isolation (i.e., allopatry) of a daughter population followed by genetic differentiation from the parental population). This would, in turn, mean that species do not evolve by anagenesis, or transformation of the entire mass of an ancestral species. A new species must pass

through a short period of ambiguity during its initial differentiation from an ancestral population, but—in the proper scaling of (macro-)evolutionary time—this period passes so quickly (i.e., almost always in the geological moment of a single bedding plane), that operational definability encounters no threat (Gould 2002, 776–77).

Noteworthily, Jeremy B. C. Jackson and Alan H. Cheetham (1999) cite punctuated equilibrium as constraining because phylogenetic patterns generated by this theory preclude several classes of results predicted by orthodox selectionist models of gradualistic anagenesis in populations. They write: “The realities of punctuation and stasis need to be better incorporated into evolutionary studies. Punctuated speciation does not contradict conventional neodarwinian [sic] mechanisms, but it does constrain the range of probable evolutionary scenarios for speciation, evolution of life histories and macro-evolutionary trends” (Jackson and Cheetham 1999, 72). “Macroevolutionary trends,” they add, “must arise through differential rates of origination and extinction, and not by adaptive evolution within single species” (Jackson and Cheetham 1999, 76).

Gradualists do not deny that speciation often occurs by branching; they just do not grant this process of splitting any formative role in the accumulation of (macro-)evolutionary change for three reasons: (1) they conceive speciation only as an engine for generating diversity, not as an agent for changing average form within a clade (or interbreeding populations); (2) they grant little quantitative weight to the role of speciation (splitting as opposed to anagenesis) in the totality of evolutionary change—indeed, in a famous estimate that became canonical with the Modern Synthesis, the (early) Simpson (1944) claimed that about 10 percent of evolutionary

change occurred by speciation, and 90 percent by anagenetic (gradualist) change; (3) when gradualists portray speciation at all, they depict the process as two events of anagenesis proceeding at characteristically slow rates. Thus, they identify nothing distinctively different about change by speciation. Some contingency of history, they argue, splits a population into two separate units, and each proceeds along its ordinary anagenetic way. Punctuated equilibrium, on the other hand, proposes that the geological tempo of speciation differs radically from gradualistic anagenesis.

Interestingly, Gould notes the strong psychological bias that still pervades biology, which conveys a widespread impression that gradualism maintains a roughly equal relative frequency with punctuated equilibrium. Gould, however, argues that in most faunas, only a small minority of cases (less than 10 percent) show evidence of gradualism. Under this largely unconscious bias, most researchers still single out rare cases of apparent gradualism for explicit study, while bypassing apparently static lineages as less interesting or even uninformative (Gould 2002, 826). The fossil record may, after all, be 99 percent imperfect, but if one can sample a species at a large number of horizons spread over several million years, and if these samples record no net change, then a conclusion of stasis rests on the presence of data, not on absence. Stasis is data. But since facts always have to be interpreted, and thus have no independent existence in science (or in any hominid endeavor for that matter), theories grant differing weights, values, and descriptions, even to the most empirical and undeniable of observations. Darwin's explicit expectations defined evolution as gradual change; as such, generations of paleontologists learned to equate the documentation of evolution with the discovery of insensible intermediacy in a

sequence of fossils. Paleontologists therefore came to view stasis as just another failure to document step-by-step evolution. In the past half-century following its original formulation, punctuated equilibrium has prevailed against an initial skepticism of its general force and frequency, in three central empirical claims: (1) documentation of the basic mechanism in cases now too numerous and too finely affirmed to deny its status as an important phenomenon in (macro-)evolutionary pattern; (2) validation of stasis as a genuine, pervasive, and active phenomenon in the geological history of most species; and (3) establishment of predominant relative frequency in enough comprehensive and well-bounded domains to assure the control of punctuated equilibrium over substantial aspects of the phyletic geometry of (macro-)evolution (Gould 2002, 971).

Punctuated equilibrium can be distinguished from other causes of rapid change (including anagenetic passage through bottlenecks and the traditional claim of imperfect preservation for a truly gradualistic event) by the criterion of ancestral survival following the branching of a descendant. Claims for anagenetic gradualism do not challenge punctuated equilibrium, and may well be anticipated as the proper expression at the genic level (especially given the high relative frequency of random nucleotide substitutions) of morphological stasis in the phenotypic history of species. Punctuated equilibrium has done well in tests of conformity with general models, particularly in the conclusion that extensive polytomy in cladistic models may arise not only (as usually interpreted) from insufficient data to resolve a sequence of close dichotomies, but also as the expectation of punctuated equilibrium for successive branching of daughter species from an unchanged parental form in stasis (Gould 2002, 77). Punctuations can be revealed by positive

evidence in admittedly rare situations, but not so infrequent in absolute number as for it to be denied wholly. Stasis is not defined as absolute phenotypic immobility, but as fluctuation of means through time at a magnitude not statistically broader than the range of geographic variation among modern populations of similar species, and not directional in any preferred way, especially not towards the phenotype of descendants. Punctuated equilibrium will be validated, as all such theories in natural history must be (including natural selection), by predominant relative frequency, not by exclusivity. Gradualism certainly can and does occur, but at very low relative frequencies when all species of a fauna are tabulated, and when we overcome our conventional bias for studying only the small percentage of species qualitatively recognized beforehand as having changed through time.

Punctuated equilibrium emerges as the expected scaling of ordinary allopatric speciation into geological time, and does not suggest or imply radically different evolutionary mechanisms at the level of the origin of species. Understand that without speciation, there would be no diversification of the organic world and thus no adaptive radiation. The species, then, is the keystone of evolution (Mayr 1963, 621). Other proposed mechanisms of speciation, including most sympatric modes, envision rates of speciation even faster than conventional allopatry, and are therefore even more consistent with punctuated equilibrium. The radical features of punctuated equilibrium flow from its proposals for (macro-)evolution, with species treated as higher-level Darwinian individuals analogous to organisms in (micro-)evolution.

According to Gould, no paleontologist would assert punctuated equilibrium from the evidence of over-split taxa in faunal lists, but only from direct biometric study of stasis and

punctuation in actual data (Gould 2002, 76). According to Gould, moreover, hominid evolution must also be rethought as reduction of diversity to a single species of admittedly spectacular (but perhaps quite transient) current success. After all, speciation has replaced linearity as the dominant theme for all major phases of hominid evolution. The current status of our interbreeding population as a single species represents an oddity, not a generality: i.e., only one hominid species now inhabits this planet, but most of hominid history featured a multiplicity, not a unity—and such multiplicities constitute the raw material of (macro-)evolution. In addition, the last 50,000 years or more of hominid phenotypic stability is a theoretical expectation under punctuated equilibrium, and not the anomaly so often envisaged (Gould 2002, 79) (for more on this subject, see the book-length retellings of hominid history centered upon this revisionary theme of bushiness vs. linearity in Tattersall and Schwartz 2000; and Johanson and Edgar 1996).

Gould lists a couple of primary claims of punctuated equilibrium in his *TSoET*, and they are worth noting *in extenso*. First of all, the theory of punctuated equilibrium treats a particular level of structural analysis tied to a particular temporal frame. Punctuated equilibrium is not a theory about all forms of rapidity, at any scale or level, in biology. Instead, punctuated equilibrium addresses the origin and deployment of species in geological time. Punctuated equilibrium—a particular punctuational theory of change and stability for one central phenomenon of evolution—does not directly address the potentially coordinated history of faunas, or the limits of viable mutational change between a parental organism and its offspring in the next generation.

So then, second, the theory of punctuated equilibrium attempts to explain the (macro-)evolutionary role of species and speciation as expressed in geological time. Its statements about rapidity and stability describe the history of individual species, and its claims about rates and styles of change regard the mapping of these individual histories into the unfamiliar domain of "deep" (or geological) time. As such, the claims of punctuated equilibrium presuppose the proper scaling of (micro-)evolutionary processes into geological immensity. This, of course, is the central point that Darwin missed when he (falsely) assumed that "slowness" of modification in domesticated animals, as measured in hominid timespans, would translate into geological time as the continuity and slowness of phyletic gradualism (Gould 2002, 79–81).

Gradualism vs. Stasis, Part I

Gradualism may represent the most central conviction residing both within and behind all of Charles Darwin's thought. Indeed, gradualism significantly antedates natural selection among his concerns, and casts a far wider shadow over his subjects of study. For example, gradualism is the explanatory framework for his first substantive book on coral reefs (Darwin 1842), and for the last book in his career on the formation of topography and topsoil by earthworms (Darwin 1881). Notably, these are two works largely lacking reference to any conceptioning of natural selection. Gradualism, as an all-encompassing concept was equated with rationality itself by Darwin's chief influence, Charles Lyell. Furthermore, many—if not most—scholars have noted the centrality of gradualism in the ontogeny of Darwin's thought (see Gruber and Barrett 1974; Mayr 1991).

Gradualism has three distinct meanings in Darwinian traditions and in Darwin himself, with only the second (or intermediate) statement relevant to the central assertion of selection's creativity. First, gradualism is simple historical continuity of "stuff" or information underlying the basic factuality of evolution, and does not validate any particular mechanism of evolutionary change. Second, gradualism as insensible intermediacy of transitional forms specifies the middle position required by the mechanism of natural selection to refute the possibility that saltational variation might engender creative change all at once, which would thus relegate selection to a negative role of removing the unfit. Third, gradualism is a geological claim for slowness and smoothness (but not constancy) of rate, and plays a crucial role in the third theme of selection's scope—or the extrapolatability of (micro-)evolution to explain all patterns in geological time. It is this third aspect of gradualism, therefore, that punctuated equilibrium refutes (Gould 2002, 60–61). For Gould (and Eldredge too), if the tiny increment of each step remains inconsequential in itself in a gradualistic framework, then creativity as such resides in the summation of these steps into something substantial—and in Darwin's theory natural selection acts as the agent of accumulation.

Regarding gradualism, Darwin himself seemingly forever struggled for clarity and consistency. However, he did not always succeed. Indeed, Darwin was consistently inconsistent and ambivalent in his discussions of gradualism in nature. Also, Darwin did not always keep the different senses of gradualism distinct. He frequently, for example, conflated meanings, arguing that the validity of natural selection (in sense two of the above paragraph) required an acceptance of slow and continuous flux (sense three above). Consider the following familiar passage: "It

may be said that natural selection is daily and hourly scrutinizing, throughout the world, every variation, even the slightest… We see nothing of these slow changes in progress, until the hand of time has marked the long lapse of ages" (Darwin 1859, 84).

This conflation of senses probably came unconsciously to Darwin, in large part because gradualism stood prior, in commitment, to natural selection as his core belief about the nature of nature. Natural selection exemplified gradualism, not vice versa—and the various forms of gradualism converged to a single, coordinated view of life that extended far beyond natural selection and even the theory of evolution itself. Again, this situation inspired Huxley's immense frustration as he intimated to Darwin that he would have enough trouble convincing people about natural selection; why, then, does he insist upon uniting this theory with an unnecessary (and false!) claim for strict gradualism? In fact, T. H. Huxley's savvy, and only quasi-criticism of the *Origin*, still rings true: in his famous letter to Darwin, written just after the *Origin* was published, he notes that he would be willing to "go to the stake" for Darwin's overall view. But he also wrote to Darwin: "You have loaded yourself with an unnecessary difficulty in adopting *Natura non facit saltum* so unreservedly" (Huxley 1901, 189). Thus, Huxley could oppose gradualism and still consider himself a supporter of natural selection; his role as "Darwin's bulldog"—that is, his intemperately ferocious defense of evolutionary theory in general—rested upon his promotion of evolution itself, not support of Darwin's gradualism.

This importance of gradualism underlies Darwin's frequent invocation of the Leibnizian and Linnaean aphorism, *Natura non facit saltum* (i.e., nature does not proceed by leaps). Darwin's commitment to this postulate was overwhelming, as can be found in some of his most

important writings. For example, Darwin writes: “If it could be demonstrated that any complex organ existed, which could not possibly have been formed by numerous, successive, slight modifications, my theory would absolutely break down” (Darwin 1859, 189). Of course, “my theory” refers specifically to the mechanism of natural selection, and not simply to the assertion of evolution itself. Indeed, Darwin often draws an explicit link between selection as a creative force and gradualism as a necessity: “Undoubtedly nothing can be effected through Natural Selection except by the addition of infinitesimally small changes; and if it could be shown that… transitional states were impossible, the theory would be overthrown” (Darwin 1975, 250). Also, Darwin mentions this principle in the concluding chapter of the *Origin*: “As natural selection acts solely by accumulating slight, successive, favorable variations, it can produce no great or sudden modification; it can act only by very short and slow steps. Hence the canon of ‘*Natura non facit saltum*’… is on this theory simply intelligible” (Darwin 1859, 471).

Rather, the clear predominance of an empirical pattern of stasis and abrupt geological appearance as the history of most fossil species has always been acknowledged by paleontologists, and remains the standard testimony of the best specialists in nearly every taxonomic group. Notably, George Gaylord Simpson, the greatest and most biologically astute paleontologist of the twentieth century (and a strong proponent of punctuated equilibrium in his later years), acknowledged the literal appearance of stasis and geologically abrupt origin as the outstanding general fact of the fossil record, and as a pattern that would “pose one of the most important theoretical problems in the whole history of life,” if Darwin’s argument for artifactual

status failed (Simpson 1960, 149). Simpson also stated at the 1959 C.E. Chicago centennial celebration for *On Origin of Species* that

> it is a feature of the known fossil record that most taxa appear abruptly. They are not, as a rule, led up to by a sequence of almost imperceptibly changing forerunners such as Darwin believed should be usual in evolution. A great many sequences of two or a few temporally intergrading species are known, but even at this level most species appear without known intermediate ancestors, and really, perfectly complete sequences of numerous species are exceedingly rare . . . These peculiarities of the record pose one of the most important theoretical problems in the whole history of life: is the sudden appearance… a phenomenon of evolution or of the record only, due to sampling bias and other inadequacies? (Simpson 1960, 149).

Anatomy may fluctuate through time, but the last remnants of a species usually look rather much like the first representatives. In proposing punctuated equilibrium, Eldredge and Gould did not discover, or even rediscover, this fundamental fact of the fossil record. Paleontologists have always recognized the long-term stability of most species. However, once gradualism emerged as the expected pattern for documenting evolution (through Darwin's appropriation of Lyell)—with an evident implication that the fossil record's dominant signal of stasis and abrupt replacement can only be a sign of evidentiary poverty—paleontologists became even less likely to showcase their primary datum of stasis. After all, if most fossil species changed gradually during their geological lifetimes, biostratigraphers would have codified "stage of evolution" as the primary criterion for dating by fossils. In a world dominated by gradualism,

resolution would be obtained by specifying a precise stratigraphic position within a continuum of steady change. But, in fact, biostratigraphers treat species as stable entities throughout their documented ranges because the vast majority appear as such in the empirical record. Biostratigraphers have known for numerous years that morphological stability, particularly in characters that allow us to recognize species-level taxa, is the rule, not the exception. It is time for evolutionary theory: (1) to catch up with empirical paleontology; (2) to confront the phenomenon of evolutionary non-change; and (3) to incorporate it into our theory. It must do this, in fact, rather than simply explaining it away:

We believe that, unconsciously, biostratigraphic methodology has been evolutionarily based all along, since biostratigraphers have always treated their data as if species do not change much during their [presence in any local section], are tolerably distinguishable from their nearest relatives, and do not grade insensibly into their close relatives in adjacent stratigraphic horizons (as per Gould 2007, 22).

Indeed, Gould and Eldredge's elevation of stasis to visibility, respectability and even to expectation, has generated subtle and interesting repercussions for gradualism. When gradualism enjoyed status as a virtually definitional consequence of evolution itself, few researchers thought to question such an anticipated result. However, once stasis emerged as an alternative norm, with gradualism designated as uncommon by the same analysis, then gradualism itself fell under scrutiny. With this shift of perspective, a paradox emerges into clear view: gradualism, *prima facie*, represents a "weird" result, not an anticipated and automatic (macro-)evolutionary expression of natural selection—which thus, perhaps, accounts for its rarity. Geological

gradualism operates far too slowly to yield any workable effect at all when properly scaled down and translated to the immediacy of natural selection in local populations. Gradualism, then, should be viewed as a problem and an anomaly, not as an expectation.

In *On the Origin of Species*, Darwin summarizes his entire argument by quoting Lyell's metaphor of the "book":

> For my part, following out Lyell's metaphor, I look at the natural geological record, as a history of the world imperfectly kept, and written in a changing dialect; of this history we possess the last volume alone, relating only to two or three countries. Of this volume, only here and there a short chapter has been preserved; and of each page, only here and there a few lines. Each word of the slowly-changing language, in which the history is supposed to be written, being more or less different in the interrupted succession of chapters, may represent the apparently abruptly changed forms of life, entombed in our consecutive, but widely separated, formations (Darwin 1859, 310–11).

Gradualism vs. Stasis, Part II

In Darwinian traditions, this pattern has been attributed to imperfections of the geological record that impose this false signal upon the norm of a truly gradualistic history. Darwin's argument may work in principle for punctuational origin, but stasis is data and cannot be so encompassed. Therefore, the traditional argument from imperfection of the fossil record has stymied the study of evolution by paleontologists because the record's primary (and operational) signal has been dismissed as misleading, or as "no data"—that is, stasis itself (Gould 2002, 76). Punctuated equilibrium, while not denying imperfection, regards this signal as a basically

accurate record of evolution's standard mode at the level of the origin of species. In particular, before the formulation of punctuated equilibrium, stasis had been read as an embarrassing indication of absence of evidence for the desired subject of study—that is, of data for evolution itself, falsely defined as gradual change—and this eminently testable, fully operational, and intellectually fascinating (and positive) subject of stasis had never been subjected to quantitative empirical study.

This situation has changed dramatically during the last fifty-years. The key empirical ingredients of punctuated equilibrium—punctuation, stasis, and their relative frequencies—can be made testable and defined operationally. The theory only refers to the origin and development of species in geological time, and must not be misconstrued (as so often done) as a claim for true "saltation" at a lower organismal level, or for catastrophic mass extinction at a higher faunal level. This assertion seems clear to me, but is highly misconstrued by other biologists. The phenomenon of stasis, seemingly, always existed in nature, but punctuated equilibrium largely created the category of stasis as an important item in evolutionary theory through a four-step process of: (1) defining stasis as a positive thing with properties and boundaries, a phenomenon rather than an unnamed and unexplained absence of evolution; (2) bringing stasis to visibility as the expectation of a theory of evolutionary modalities; (3) suggesting methods for the rigorous study of stasis, so that the concept could be operationalized; and (4) granting importance to stasis as a topic with broad implications for revising traditional modes of thought in evolutionary biology (Gould 2002, 875).

As Gould wrote *TSoET*, a full quarter-century after his and Eldredge's (1972) initial presentation and definition, stasis had become an even more general and important issue in evolutionary theory for three reasons: (1) its frequency; (2) its generality; and (3) its causality. Regarding its frequency, once the phenomenon had been named, and criteria established for recognition and study, researchers documented stasis at an extremely high relative frequency. Thus, it represents (or at least "should") the evolutionary norm and expectation. Such predominance, in fact, implicates stasis as a property actively maintained by species. Gradualism has become, thereby, both a rarity and a puzzle, and it is now generally regarded as an infrequent, if not downright *anomalous*, phenomenon in evolution. Regarding its generality, interest in stasis—originally generated by punctuated equilibrium for inquiries at the appropriate level of species durations through time—then expanded to other domains of size and time, and to more comprehensive questions about the nature of change itself. While causes operating at punctuated equilibrium's proper scale will not explain other forms of stasis, the generalized definition and inquiry arose by expansion from Eldredge and Gould's hypothesis (1972). Gould states that he also anticipates the identification of some common causes or constraints—that is, in evolutionary parlance, causal parallelisms, based on structural homologies, rather than convergences or mere analogies of appearance—behind the deeper generality (with different immediate forces producing similar and partly homologous results at various levels) (Gould 2002, 876). With regard to this comment by Gould about causal parallelisms, he could not have been more prescient. More about this later.

Regarding its causality, fruitful debate about the causes of stasis must first specify the level manifesting the common phenomenology. Gould orders the major propositions for explaining stasis at the scale of punctuated equilibrium as an array running from conventional resolutions based on Darwinian organismic selection to more iconoclastic proposals invoking either higher levels of causation or less control by selection and adaptation. Much of the genuine interest in the otherwise tedious and tendentious debate on the theoretical novelty of punctuated equilibrium, Gould notes, lies in the legitimate weights that will eventually be assigned to the proposals of stabilizing selection, and developmental and ecological plasticity (Gould 2002, 877–78). For example, to most evolutionists who choose to see nothing new in punctuated equilibrium, the previously unacknowledged frequency of stasis only indicates a stronger role than previously envisaged for the conventional mechanism of stabilizing selection. Although this putative explanation of stasis within paleospecies achieved an almost canonical status among evolutionists who tried to create complete compatibility between punctuated equilibrium and the Modern Synthesis, and although stabilizing selection is still acknowledged as important and pervasive as a phenomenon, a complete explanation of stasis in these conventional terms is implausible on empirical grounds, and also improbable by the basic logic of scaling.

Punctuation and Stasis

Once it is recognized that definitions for the two key concepts of stasis and punctuation describe the history of individual species scaled into geological time, one can establish sensible operational criteria. As a central proposition, punctuated equilibrium holds that the great majority of species, as evidenced by their anatomical and geographical histories in the fossil record,

originate in geological “moments” (punctuations) and then persist in stasis throughout their duration of existence. This central proposition embodies three concepts requiring operational meanings: stasis, punctuation, and dominant relative frequency. Stasis does not mean utter invariance of average values for all traits through time. Rather, in the (macro-)evolutionary context of punctuated equilibrium, one needs to know, above all, whether or not morphological change tends to accumulate through the geological lifetime of a species and, if so, what part of the average difference between an ancestral and descendant species can be attributed to incremental change of the ancestor during its supposed anagenetic history.

Punctuated equilibrium makes the strong claim that, in most cases, effectively no change accumulates at all. A species, at its last appearance before extinction, does not—seemingly—differ systematically from the anatomy of its initial entry into the fossil record, usually several million years before. Punctuated equilibrium makes no claim about the possibility of substantial change at rates that would be called rapid by the measuring rod of a hominid lifetime. Therefore, punctuated equilibrium provides no insight into the old and contentious issue of either saltational or macro-mutational speciation. By definition, an event of speciation that occurs within the span of time recorded by most bedding planes will rarely be resolvable because evidence for the entire transition will be compressed onto a single stratigraphic layer, or a proverbial geological “moment.” Punctuations must, instead, be defined relative to the subsequent duration of the derived species in stasis—this is because punctuated equilibrium, as a theory of relative timing, holds that species develop their distinctive features effectively at their origin (or birth), and then retain them in stasis for geologically long lifetimes.

So then, the theory of punctuated equilibrium adopts a very "conservative" position on speciation; the theory asserts no novel claim about modes or mechanisms of speciation: i.e., punctuated equilibrium merely takes a standard (micro-)evolutionary model and elucidates its expected expression when properly scaled into geological time. This scaling into geological time, however, provokes a radical reinterpretation of paleontological data—for punctuationalists argue that the literal appearance of the fossil record, though conventionally dismissed as an artifact of imperfect evidence, may actually be recording the workings of evolution as understood by neontologists.[19] This empowering switch enables paleontologists to cherish their basic data as adequate and revealing, rather than pitifully fragmentary and inevitably obfuscating. Paleontology could and should therefore emerge from the intellectual sloth of debarment from theoretical insight imposed by poor data—a self-generated inertia that had confined the field to only a descriptive role in documenting the actual pathways of life's history—to take a deserved and active place among the evolutionary sciences.

In fact, in a sense, punctuated equilibrium makes no real claim about speciation at all. The radicalism of punctuated equilibrium lies, rather, in the extensive consequences of its key implication that conventional mechanisms of speciation scale into geological time as the observed punctuations and stasis of most species. Contrast this with the elusive gradualism that a century of largely fruitless paleontological effort had sought as the only true expression of evolution in the fossil record (in order to remain within Darwinian orthodoxy). The central

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[19] All professions maintain their parochialisms, and Gould hopes that non-paleontological readers will understand that he and Eldredge are paleontologists, so they developed a name to contrast themselves with all the biologists who study modern organisms in hominid or ecological time. We biologists, therefore, became "neontologists" (Gould 2002, 778).

intellectual strategy of Eldredge and Gould's original 1972 C.E. paper rests upon this premise: i.e., they merely took Mayr's (1963) allopatric theory of speciation, and tried to elucidate its expression when scaled into geological (or "deep") time.

Gould and Eldredge chose Mayr's formulation, in part, because his allopatric theory represented the most orthodox and conventional view of speciation then available in biological (or neontological) literature, but inadvertently, it also fit the paleontological data well. Indeed, in Mayr's allopatric speciation model, daughter species originate in two circumstances that virtually guarantee a punctuational expression in the fossil record: (1) they arise rapidly (or even "instantaneously") in geological time; and (2) they originate in a small geographic region (i.e., on the periphery). This sudden entrance of a "daughter" species into strata previously occupied by "parental" species usually represents the inward migration of a peripheral isolate, now "promoted" by reproductive isolation to full separation, not the origin of a new species *in situ* (Gould 2002, 780). In developing punctuated equilibrium circa 1971 C.E., Gould originally hoped that punctuated equilibrium would influence the practice of paleontology by showing that the fossil record, read literally, might depict the process of evolution as understood by neontologists, and not only reflect an *absence* of evidence. But he had no premonition about the uproar that punctuated equilibrium would generate for our general inability to know the contingencies of external history.

We might say that Gould and Eldredge had either been panderers to fashion—and therefore destined for ashheap of history—or they had a spark of insight about nature's constitution. I suppose, though, that our observations about that notion are no more colored than

Darwin's: we see gradual change because we go looking for it; we find it because we need it. Natural history is, as Gould oft writes, a series of plateaus punctuated by rare and seminal events that shift biological systems from one level to another. Perhaps, however, that is enough. Indeed, perhaps only the punctuational, contingent, and unpredictable future can discern the value of punctuated equilibrium. As a species, however, we often underestimate the suddenness, the contingency, and even the randomness of change itself, and that to our corporate detriment. I would now like to transition to Gould's own revisions to structuralism and internalism.

Revised Gouldian Structuralism and Internalism

In a revised world of structuralism, we might say that Darwin first located and embellished one of the few brilliant and coherent positions in an intellectual universe with few contentions around a central core. The formalist commitment implies an aversion to primary explanation by adaptation, function or final cause. According to the "late"-Gould, internal formation acts as a primary source that must find external conditions (Gould 2002, 288). Adaptation may then shape a range of diversity from an underlying form, but the archetypal pattern cannot be explained by these secondary modifications, and the adaptations themselves can only express a superficial restructuring of inherent order. In formalist or structuralist theories, the strongest correlation unites a commitment to generative laws of form with an aversion to adaptationist explanation as the primary goal of morphology. The two commitments need not conjoin in logic or empirical necessity. Indeed, Darwin found a brilliant argument to drive them apart by identifying most (though not all) generating principles as past adaptations, and relegating remaining "laws of form" to a peripheral or secondary status.

In contrast, almost every formalist theory of morphology views adaptation as secondary "tinkering" rather than primary structuring. For Darwin, discontinuity originates by historical contingency in a fully accessible and isotropic morphospace: *Natura non facit saltum*. But the universe of formalism—in morphology at least—views discontinuity as inherent in the structure of all inhabitable space. Gould emphasizes a primary intellectual correlation of formalism with commitment to internal constraint in the positive sense of channeling change, not only the negative definition of restriction. To render this connection meaningful, the converse must also be true: i.e., strict functionalism must correlate with denial of constraint (Gould 2002, 296).

The boldest version of the formalist argument for vertebrates hypothesizes a comprehensive unity of type across an entire phylum—with all elements present in all species (if only in embryos, or fused in adults), and with no new elements originating for specific functions. This strict account embodies both meanings of constraint: (1) the negative sense of limitation in restriction of elements to pieces of the archetypal jigsaw puzzle; and (2) the positive sense of directed channels providing numerous, though ordered, possibilities for modified shapes that are predictable from the channels, and implied by observed developmental pathways (Gould 2002, 299). Formalist commitment, though, directly implies an aversion to primary explanation by adaptation, function or final cause (i.e., teleology). In fact, for strict formalists, internal formation acts as a primary source that must *find* external conditions. Adaptation may then shape a range of diversity from an underlying form, but the archetypal pattern cannot be explained by these secondary modifications, and the adaptations themselves can only express a superficial *restructuring* of inherent order.

The Noxious Persistence of "Progress"

Indeed, the attempt to validate human superiority by the doctrine of progress identifies the heaviest burden imposed by Western culture upon evolutionary views of all varieties. We hominids particularly yearn for explanations based on anticipated progress, rather than contingent origins of small and isolated populations in limited local regions. We want to regard our (modern human, i.e.) origin as the necessary, or at least predictable, crest of an environmental flux, not as the chancy outcome of a single event unfolding in a unique time and place. This tendency, I believe, best illustrates the deep-seated nature of prejudices that must be overcome if we hominids wish to grasp the truly radical Darwinian character of (macro-)evolution as change wrought by differential success of favored individuals within variable populations—thus finally breaking the Platonic chain of defining evolution as improvement of an archetypal form.

Niles Eldredge advocated this transition by contrasting "taxic" approaches to evolution with the older "transformational" view (Eldredge 1979, 7–19).[20] However much we hominids may yearn to regard ourselves as the apotheosis of an inherent tendency of the unfolding in nature, we must someday recognize our actual status as a discrete and singular item in the contingent and unpredictable flow of history.[21] After all, most species—especially those with large, successful, highly mobile, globally spread, environmentally diverse, and effective populations like us (late-)modern hominids remain stable throughout their history, at least

[20] In the particular context of hominid evolution, Gould himself labelled multiregionalism as a "tendency theory," and the out-of-Africa hypothesis as an "entity theory" (Gould 1998a, 173).

[21] If we modern-day hominids could only bring ourselves to view this prospect as exhilarating rather than frightening, we might attain the psychological prerequisite for intellectual reform, Gould claims (Gould 2002, 912).

following their initial spread, especially under the model provided by punctuated equilibrium. Change occurs by punctuational speciation of isolated subgroups, not by geologically slow anagenetic transformation of an entirety (Gould 2002, 913).

In their nineteenth-century versions, all three critiques of the essential postulates of Darwinism (the three legs that Gould mentions throughout *TSoET*) sunk their taproot in the concept of progress. For example, for the first leg of the agency of selection, the original hierarchical model of Lamarck construed its higher level of large-scale change as a force of progress orthogonal to a palpable cause of local adaptation. For Lamarck, indeed, the two forces of general progress and local adaptation are not only geometrically orthogonal (upwards vs. sidewards), but also conceptually opposed, as the lateral force "pulls" lineages from their upward course into dead-ends of local specialization. For the second leg of selection's efficacy, most structuralist visions postulated an inherent increase of complexity and progress mediated by laws of form and internal principles of living matter; these internalist theories proved attractive initially because, in contrast with the Darwinian contingency of shifting local adaptation, they offered more promise as validations for the great balm of progress. On the third leg of extrapolation, while catastrophism might seem inherently opposed to an idea of predictable increase in life's complexity, the classical versions of it advocated an intimate connection between progressionism and spasmodic change, as pre-Darwinian catastrophists generally postulated renewed faunas of increasing excellence after each episode of extinction (Gould 2002, 588). We will discuss "progress" in (macro-)evolutionary biology more fully in the next section, and then even more fully in next chapter within this dissertation.

Darwin's Abysmal Failure(s)

Darwin got a great deal right, and he organized even more material into an internally coherent logic of argument. But he failed to achieve resolution on several important issues (especially when cultural convention clashed with implications of his theory), including some questions of great salience for him. Darwin's greatest failure of resolution centered on an issue that assumed cardinal importance in Victorian culture—progress (both its definition, and its empirical justification).[22] In his most radical intellectual move, expressing both the transforming depth and the conceptual originality of the theory of natural selection, Darwin denied the existence of a primary progressive force, while promoting the lateral force of adaptation to near exclusivity. In so privileging uniformitarian extrapolation as an explanatory device, Darwin imbued natural selection, the lateral force, with sufficient power to generate evolutionary change at all scales by accumulating tiny adaptive increments into a summative display of complexity through the immensity of geological time. Or, did he?

For Darwin, struggle and competition entered the ontogeny of thought for a variety of reasons related to Malthus: the necessary resource for powering natural selection, and views on the plenitude of nature, for example. Struggle also serves many functions in the logic of Darwin's completed theory; primarily, however, these views on struggle validate the concept of progress as a cardinal trajectory in the history of life. Darwin invoked his own interpretation of struggle—in particular, his conviction about the predominance of biotic competition—as an

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[22] Several key figures of the Modern Synthesis devoted books to the subject of progress, notably Julian Huxley (1953), George Gaylord Simpson (1949), Theodosius Dobzhansky (1967); and G. Ledyard Stebbins (1969). Also, volumes still appear with great regularity, for example, Nitecki (1988); see Ruse (1996) for a positive evaluation of progress, and also see Gould (1996a) for a contrary view on it.

"added" principle to guarantee a pattern of progress that could not be derived, without such an auxiliary, from natural selection in its most abstract and generalized form. The domination of biotic competition as a patterning agent requires that geological history proceed in a particular way: the stage of environmental change must permit the Darwinian play to not only operate, but truly dominate, in the natural world as we know it.

After all, even the most logical and brilliant theory can do no explanatory work if surrounding conditions never permit its results to emerge. The link of struggle with overt battle plays a crucial role in Darwin's thought: he included both biotic competition and its prevalence in difficult environments within his larger concept of struggle, and remarkably regarded all forms of biotic competition, including symbiosis and symbolic posturing for mating success, as modes of struggle. Nonetheless, by emphasizing biotic over abiotic competition, and by stressing examples leading to the death of losers, Darwin favored the close analogs of battle. Thus, Thomas Henry Huxley frequently referred to natural selection as the "gladiatorial theory" of existence and urged us hominids to determine nature's ways and then act in an opposite manner (Huxley 1894, 136).

Petr Kropotkin has generally been viewed as idiosyncratic and politically motivated in his famous attack on Darwinian competition, and in his advocacy of cooperation as the norm of nature, as especially expressed in *Mutual Aid: A Factor in Evolution* (1902). Kropotkin, who was well-trained in biology, argued that density-independent regulation by occasional, but severe, environmental stress will tend to encourage intraspecific cooperation as a "normal" mode of natural selection (see Todes 1987; Gould 1991). If populations are generally at their carrying

capacity, with numbers not fluctuating much, then biotic competition must dominate, for no group can increase except at the expense of others. However, if by mutual aid the members of the population can counteract environmental stress, Kropotkin contends that any given world can support more of any population. Darwin himself strongly subscribed to this version of the ancient principle of plenitude, arguing from his favored Malthusian base that a population's geometric capacity for growth guarantees the (geologically) instantaneous achievement of optimal numbers: "From the high geometrical powers of increase of all organic beings, each area is already fully stocked with inhabitants" (Darwin 1859, 109).

Relatedly, "trends" represent the primary phenomenon of evolution at higher levels and longer time scales. Trends therefore pose the key challenge—the ultimate making or breaking point—for extrapolationist theories that seek the causes of (macro-)evolution in (micro-)evolutionary processes centered upon organismic selection. Darwin understood and accepted this challenge: his principle of divergence is the attempt to depict "progressive trends" as extrapolated results of natural selection. Indeed, Darwin's principle of divergence attempts to explain morphological trends by specialization and progressive departure from ancestral form, and also to account for numerical trends by multiplication of some taxa at the expense of others within a population of interbreeding organisms (i.e., clades).

For proponents of punctuated equilibrium, however, speciation represents the primary source for morphological changes that, by summation of increments, build trends in the history of lineages (Gould 2002, 792). Indeed, punctuated equilibrium posits that tolerably gradual trends in the overall history of phenotypes within major lineages and interbreeding populations

should reveal a punctuational fine texture when placed under the proverbial microscope of dissection to visualize the individual (speciational) building blocks of the totality—what Gould has long called the "climbing up a staircase" rather than the "rolling a ball up an inclined plane" model of structure for "progressive" trends (Gould 2002, 807). Other scholars agree with Gould on this point. For example, Jackson and Cheetham conclude: "Granted the prevalence of punctuated equilibria, macroevolutionary trends must arise through differential rates of origination and extinction, and not by adaptive evolution within single species. All of this is compatible with traditional neodarwinian [sic] evolutionary biology, but was unexpected before the theory of punctuated equilibria" (Cheetham and Jackson 1995, 186). The apparatus of punctuated equilibrium explains why "progressive" trends display a punctuated pattern at geological scales. Punctuational accounts of "progressive" trends propose an allometric model for any relevant scale—that is, any proverbial microscope placed over higher-level smoothness of (macro-)evolution will reveal an underlying "stair-step" pattern among constituent causal individuals acting as Darwinian agents of the "progressive" trend (Gould 2002, 808).

Darwin's Dilemma—"Conditions of Existence" or "Unity of Type"?

Darwin follows a tradition of dichotomy in a passage that he earmarked for special impact as the concluding paragraph of his crucial chapter (6) in the *Origin*, titled "Difficulties on Theory." Gould regards this passage as among the most important and portentous in the entire *Origin*, for these words embody Darwin's ultimate decision to construct a functionalist theory based primarily on adaptation, and to relegate the effects of constraint—and thereby of formalism itself—to a periphery of low relative frequency and subsidiary importance (Gould

2002, 252). Yet this passage, which should be emblazoned into the consciousness of all evolutionary biologists, has rarely been even acknowledged or, much less, quoted. Darwin, expressing his alternatives in upper case, uses the categories of the great debate between Cuvier and Geoffroy: “It is generally acknowledged that all organic beings have been formed on two great laws—Unity of Type, and the Conditions of Existence” (Darwin 1859, 206).

Conditions of Existence, of course, express the principle of adaptation—final cause or teleology to pre-evolutionists: in such a conception, organisms are well designed for their immediate modes of life—and intricate adaptation implies an agent of design, either by an intelligent creator who made organisms by fiat as an expression of his wisdom and benevolence, or by a natural principle of evolution that yields such adjustment between organism and environment as a primary result of its operation. Both Darwinian natural selection and Lamarckian response to perceived needs build adaptation as the most general consequence of their basic mode of action. Darwin then continues by defining the other side of the classical dichotomy—Unity of Type: “By unity of type is meant that fundamental agreement in structure, which we see in organic beings of the same class, and which is quite independent of their habits of life” (Darwin 1859, 206). In another critically placed passage, introducing the subject of “Morphology” in chapter 13 of the *Origin*, Darwin waxes almost poetic about unity of type:

This is the most interesting department of natural history, and may be said to be its very soul. What can be more curious than that the hand of a man, formed for grasping, that of a mole for digging, the leg of the horse, the paddle of the porpoise, and the wing of the bat, should all be

constructed on the same pattern, and should include the same bones in the same relative proportions [?] (Darwin 1859, 434).

These two principles have always dwelled together in exquisite tension: any complete account of morphology must therefore call upon both phenomena, for most organisms are well adapted to their immediate environments, but also built on anatomical ground plans that transcend any particular circumstance (Gould 2002, 252). Yet the two principles seem opposed in a curious sense—for why should structures adapted for particular ends root their basic structure in homologies that do not now express any common function (as in Darwin's example of mammalian forelimbs)? For the most part, the designation of one principle or the other as the causal "foundation" of biology virtually defines the position of any scientist towards the organic world and its causes of order (see Russell 1916 on this dichotomy). Should we regard the plan of high-level taxonomic order as primary, with local adaptation viewed as a set of minor wrinkles (often confusing) upon an abstract base? Or do local adaptations build the entire system from the bottom-up? This dichotomy set the major debate of pre-Darwinian biology: does God reveal himself in nature primarily by the harmony of taxonomic structure, or by the intricacies of particular adaptations? This dichotomy continues to define a major issue in (late-)modern evolutionary debates also: does functional adaptation or structural constraint maintain priority in setting evolutionary pathways and directions? After all, if physical forces shape organisms directly, then their prior "histories" do not matter, and we need only consider the immediate impress of current circumstances upon malleable organic materials (Gould 2002, 1181). This issue of primacy between the two principles has held the central stage of natural history for so

long that national traditions have developed, with Continental preferences usually emphasizing unity of type (despite important exceptions like Georges Cuvier), and mainstream anglophonic science generally favoring adaptation (with exceptions of the pluralists like Richard Owen, or dissenters like William Bateson and D'Arcy Thompson).

Darwin writes in *Origin*, in a few sentences that define the causal basis of his theory, the following words:

> On my theory, unity of type is explained by unity of descent. The expression of conditions of existence, so often insisted on by the illustrious Cuvier, is fully embraced by the principle of natural selection. For natural selection acts by either now adapting the varying parts of each being to its organic and inorganic conditions of life; or by having adapted them during long-past periods of time: the adaptations being aided in some cases by use and disuse, being slightly affected by the direct action of the external conditions of life, and being in all cases subjected to the several laws of growth. Hence, in fact, the law of the Conditions of Existence is the higher law; as it includes, through the inheritance of former adaptations, that of Unity of Type (Darwin 1859, 206).

Darwin makes his fundamental choice by affirming fealty to the English adaptationist tradition, as the above passage clearly demonstrates. He argues that ancestral structures, forming the great homologies of Unity of Type, initially arose—by natural selection!—as adaptations to "organic and inorganic conditions of life" in ancestral environments. Thus, the dichotomous poles of Unity of Type and Conditions of Existence achieve a single and unified explanation under natural selection—as immediate adaptations to present environments (Conditions of

Existence), or as adaptations to ancient environments, transmitted by (some form of) inheritance to diversified descendants (Unity of Type). The old dichotomy, in fact, expresses no clash of opposites at all, but instead only marks the temporally sequential representations of one dominant principle in evolution—adaptation by natural selection. Thus, since adaptation embodies the principle of Conditions of Existence, and since adaptation builds both ends of the old dichotomy, Conditions of Existence becomes the victorious pole of the old contrast, (in Darwin's words) the "higher law; as it includes, through the inheritance of former adaptations, that of Unity of Type."

Thus, while extending natural selection to cover both poles of the old dichotomy between unity of type and conditions of existence, Darwin also listed the main supplements to selection among causes of evolutionary change: use and disuse, direct action of external conditions, and laws of growth. Biologists roundly reject the first two today, and Darwin also granted them little space by his usage of numerous qualifiers. But Darwin put more stock in the third—laws of growth—as indicated by his *only* positive qualifier: "being in all cases subjected to the several laws of growth." According to Gould, we would offer the same judgment today, since laws of growth, under the more fashionable designation of "developmental constraints," have become a hot topic in evolutionary biology once again in the (late-)modern era (Gould 2002, 255). Darwin wrote his crucial closing paragraph of Chapter 6 of *Origin* to argue that Unity of Type should be subsumed under Conditions of Existence—for Unity of Type, he asserted, only expresses past episodes of ordinary adaptation and natural selection, subsequently inherited by numerous modern descendants. Unity of Type has always defined the main arena for naturalists who view

adaptation as secondary, and therefore also view some principle of morphological order as primary.

Unity of Type and Constraint

Darwin removed the rationale for a separate principle of Unity of Type by noting that ancient adaptations would, if inherited faithfully throughout a subsequent lineage, become sources of deep homology (Darwin 1859, 434). Yet he could not deny—and had no desire to subvert—the idea of morphological principles working separately from natural selection, and building exceptions to adaptation. In this sense, Darwin supported the concept of constraint, but only if this principle could be carefully circumscribed within a category subsidiary to natural selection in relative frequency and biological importance (Gould 2002, 255). However, by attributing both poles of the classic dichotomy (unity of type and conditions of existence) to natural selection as a primary cause, thereby robbing constraint of its potentially largest domain, Darwin granted overall dominance to adaptation, it seems to me. (Late-)modern constraint theorists, Gould included, balk at Darwin's resolution because his argument demotes a large chunk of biology to a very small corner of a very large room (Gould 2002, 256–57). The old Unity of Type theorists, lacking the alternative of "just history," falsely assumed that deep homology must stand against adaptation. But much validity still attends their cardinal insight that principles of design, laws of growth, rules of architecture, nature of materials—generalities transcending the particulars of specific genealogical pathways—work as important interior channels of constraint in the positive sense of that word: for constraints not only prevent

evolutionary motion by failing to supply variation; they also act positively to set preferred channels of change.

Internal forces, then, do not only present isotropic raw material to the fully creative externality of natural selection; no, they actually guide the external force of natural selection! Constraint does not exist in subservience to adaptation under the nooks-and-crannies and sequelae arguments of relative frequency. Constraint may never again (and rightly so) be able to claim primacy, as the old Unity of Type theorists held, in my own opinion, but a certain type of "partnership" with adaptation remains a reasonable and minimal expectation in this (late-)modern era. To the standard pre-evolutionary and dichotomous conception of the causes of form as working either by adaptation to immediate conditions of existence, or by manifestation of laws of form that reflect unity of type, Darwin literally adds a third dimension of "history" for the explanation of form. But he greatly devalues the domain previously ascribed to unity of type, admitting constraints of laws of form only by redefining such similarities as homologies based on the inheritance of past adaptations, and therefore adaptational in their origin and primarily due to the other (and now predominant) domain of conditions of existence.

As such, a current trait of an organism may arise as an immediate adaptation to surrounding environments, as a constraint not particular to the contingent history of its lineage (architectural or structural principles, correlations to current adaptations), or by inheritance of an ancestral form (often called historical or phylogenetic constraint). This distinction suggests a recursion, because contributions from the axis of "history" represent traits that, at their origin in an ancestor, arose as either adaptations or constraints. Nonetheless, the immediate form of an

organism can still be meaningfully parsed into three major contributions of: current adaptation, current constraint, and historical inheritance (Gould 2002, 258–59). Notably, these issues have pervaded natural history since Plato and Aristotle argued about abstract form vs. teleology. Truly, even one of Gould's proverbial heroes in the structuralist realm, D'Arcy Thompson, once said, "Like warp and woof, mechanism and teleology are interwoven together, and we must not cleave to the one and despise the other" (Thompson 1917, 5).

The triumph of Darwinian functionalism did, however, erase much historical memory for the old alternative of constraint. According to Gould (2002, 260) and others (including myself), our current need to reinvigorate constraint as a vital topic in evolutionary explanation—based upon advancing knowledge of development and (macro-)evolution—requires that we rediscover this legacy of structuralist thought, and recognize that the entire history of evolutionary theory has been pervaded by an issue that simply would not disappear, if only because the dialectic of inside and outside, structure and function, design and adaptation, must be resolved at some fascinating interplay and synthesis, not as a victory for either pole in a debate without true sides (for more on this idea, see Stearns 1986, 23–44; Maynard Smith et al. 1985, 265–87; Gould 1989a, 516–539; Gould 1992, 407–37). For Gould, the immediate appearance of an organ/ism in a fully formed state provides the only alternative to "history"—whether such appearance is achieved by the direct hand of a divine agent, or by spontaneous organization from elements according to some unknown law or principle of nature. If basic taxa originated as we find them now, then the range of theoretical explanation remains wide: species might be purposely ill designed to suit the "black humor" of a diabolical creator; or they might be "cobbled together"—

jury-rigged, one might say—with no rhyme or reason by forces of universal randomness (Gould 2002, 260).

With these attributes—purpose and order—as part of a cultural heritage, the basic explanations for organic form could be reduced to two major alternatives, expressing the primacy of one or the other overarching principle for a rational and "benevolent" world; these principles have historically been called structuralism and functionalism, order and teleology, laws of form and adaptation, Unity of Type and Conditions of Existence (Gould 2002, 260). Nevertheless, these poles set the dichotomy that Darwin split by introducing "history," but never really fractured because the new axis of "time" could also be divided into structural vs. functional explanations for ancestral forms. So then, this dichotomy continues to set an important agenda for evolutionary theory in the twenty-first century, especially since the overly adaptationist Modern Synthesis (representing a temporary triumph of the functionalist pole) has yielded to a pluralism of structuralist alternatives as "partners" rather than "subsidiary" forces.

In this light, I find it fascinating that the oldest tradition in modern natural history—the natural theology of so many pre-Darwinian biologists—also existed in two primary versions, expressing the two poles of the same dichotomy. Since Darwin built his evolutionary theory in continuity with the pole favored by a long English heritage—the adaptationism of William Paley—this subject cannot be dismissed as an obscure issue from a forgotten past, but remains a vital presence in our present concerns, for we contemporary biologists still struggle with "adaptation" and "constraint," just as Paley and Agassiz contrasted the comparable positions in the "old" natural theology. Do not Ronald A. Fisher vs. Sewall Wright, or Joe Cain and John

Maynard Smith vs. Brian Goodwin[23] and Stuart Kauffman carry on the same debate, evolutionarily translated?

Ironically, in November 1859 C.E., just a week before the official publication date of the *Origin*, Darwin wrote to his neighbor John Lubbock that "I do not think I hardly ever admired a book more than Paley's 'Natural Theology'. I could almost formerly have said it by heart" (Darwin 1887, 2:219). Darwin, it should be noted, often uses Paley's logic, but at times against his predecessor. This clearly insinuates that Darwin was looking for a mechanism that could "create" the kind of adaptational optimality that Paley sought to attribute to the deity. In fact, the downward shift of agency, from a purposively benevolent deity to the amoral self-interest of organisms, embodies the most distinctive and radical aspect of Darwinism, according to Gould (2002, 596).

Paleyan Functionalism and Agassiz's Formalism

Traditional natural theology held, as a central premise, that the works of nature not only demonstrated God's presence, but could also reveal his character as well. We could learn veritable things about him, and not only persuade ourselves that he exists. Paley's full title of his most adored book (1802) reads: *Natural Theology: or, Evidences of the Existence and Attributes of the Deity, Collected from the Appearances of Nature*. From this shared premise, two traditions proceeded, both "preadapted" to a later evolutionary transformation: the two alternative

[23] In his important book from the 1990s on this view of life, Brian Goodwin emphasizes the "generic" nature of order for free: "Much (and perhaps most) of the order that we see in living nature is an expression of properties intrinsic to complex dynamic systems organized by simple rules of interaction among large numbers of elements. This order is generic, and what we see in evolution may be primarily an emergence of states generic to the dynamics of living systems" (Goodwin 1994, 186).

traditions, respectively, were the great texts of Paley's *Natural Theology* (1802) and Agassiz's *Essay on Classification* (1857). The two works dovetail with remarkable symmetry in their opposition: Paley the British adaptationist vs. Agassiz the Continental formalist. Notably, the word "adaptation" did not enter biology with the advent of evolutionary theory. The Oxford English Dictionary traces it to the early-seventeenth century in a variety of meanings, all referring to the designing or suitability of an object for a particular function, or the fit of one thing to another. The British school of natural theology used "adaptation" as its standard word for illustrating God's wisdom by the exquisite fit of form to immediate function. Darwin, in borrowing this term, simply followed an established definition while completely revising the cause of the phenomenon.

Paley frames his hypothetical "opponent" in *Natural Theology* (1802) as a somewhat caricatured workbench materialist who believes that most—if not all—natural order arises from physical laws. For Paley, this opponent exists in two versions, one more "dangerous" than the other—(1) the true atheist who denies God outright; and the theist who has abandoned a directly caring and providential God for a deity who set up the laws of nature at the beginning and then bowed out; or (2) the deist who sees spirit in everything, but calls this directing force a "physical law," and not a caring, personal God. Apparently, Paley never conceptualized, as another potential opponent worthy of refutation, the possibility of a principle of selection, be it later expressed in Darwin's version, or otherwise. That is, his caricature depicts order as arising from laws of nature, but he never imagines that good order could also emerge as a residue of trying many things out and rejecting most. Such selectionism represents, to us in the (late-)modern era,

an obvious potential alternative to Paley's only conceptual model for order without apparent purpose: direct construction by the action of physical laws (Gould 2002, 263). This idea of trying many things out, but nevertheless rejecting most of the things tried-out, is exactly what I promulgate in this dissertation.

Adaptationists hold that structures must evolve or be fashioned for utility: the functional needs come first, and form follows. According to Gould, formalists argue, on the other hand, that morphology may arise for reasons other than use, with later "uptake" of function as subsidiary, i.e., form comes first, and organisms may then discover usages for that "form" (2002, 274). Importantly, Darwin frequently calls "constraint" by his preferred terminology of "correlation of growth." Notably, the formalist Louis Agassiz does not deny that organisms tend to be well "adapted;" in fact, no "true" formalist has ever made so strong a claim against the Paleyan alternative. Agassiz argues, rather—as formalists have done throughout history, no less so today—that adaptation only expresses a secondary "tinkering," one might say, or a minor adjustment of a prior and fundamental *Bauplan*, previously built by formalist principles. In its strongest version, Agassiz's brand of formalism labels adaptation as a delusion because "good fit" only confuses our search for a deeper order by imposing a superficial overlay of specific and immediate adaptation upon a *Bauplan*, thereby obscuring the more important underlying structure.

While Paley and Agassiz struggled to find the proper signature of God in nature, such an effort no longer counts as part of biology, at least writ large (I am completely dismissive of Intelligent Design Theorists). Darwin added a third, "historical" dimension, thereby fracturing

the old dichotomy of form and function, and rendering its terms virtually obsolete. Gould argues that Darwin's addition, though surely the most important and revolutionary event in the history of biology, scarcely rendered the old dichotomy irrelevant (Gould 2002, 278). So then, any morphology attributed to Darwin's "historical" dimension must still be judged by the dichotomy at its time of origin—i.e., we must still know whether an ancestral form arose by "adaptation" or "constraint" (or by a mixture of those two poles).

Thus, we may say that Darwin's new dimension of "history" expanded the scope of the dichotomy by compelling its application to two domains—past and present—when we analyze the basis of any trait in a living organism. Evolution, therefore, does not establish an ultimate divide for all transitions in the history of biology; several themes pass right through this great revision, only altering their terms and explanations, not their substance. Formalism vs. functionalism may be the most prominent and persistent of issues too grand even for evolution to fully resolve. Paley and Agassiz once fought this "battle" in grand style; Richard Dawkins and Brian Goodwin cannot cast so broad a conceptual net, or muster the same stylistic panache today, but they still pursue the same conflict. So then, Paley vs. Agassiz remains relevant to (late-)modern evolutionists by the primary criterion of genealogical continuity. As a young man, notably, Darwin adored Paley's *Natural Theology* (1802); later, in a courageous act of intellectual parricide, he constructed a theory that subverted Paley's mode of explanation. But Darwin never abandoned Paley's conviction that adaptation must be designated as the primary phenomenon of natural history. Darwin remained true to the British tradition stretching at least as far back as Robert Boyle and John Ray in the late seventeenth-century of the founding

generation for modern science, running through Paley, the Bridgewater Treatises, and Wallace in Darwin's own time, on to Ronald A. Fisher and finally to Richard Dawkins in the later twentieth-century.

If Paley and Agassiz represent the yin and yang of totality for the analysis of form, then Darwin—though a pluralist who understood both poles—ultimately cast his lot with the Paleyan yin, in filial relation to a British tradition that spanned centuries prior to his formulation, and still continues into the twenty-first century. This imbalance, and the struggle for redress that now commands so much discussion in contemporary evolutionary biology, is palpable: the formalist alternative, as embodied in the subject now generally called "constraint," provides a counterweight to stabilize the second leg in Darwin's essential tripod of support—the primacy of adaptation—in asserting the creativity of natural selection at overwhelming relative frequency among the causes of evolutionary change. Gould believes that structuralist and formalist approaches to anatomy fell out of favor for invalid reasons of fashion, and that the full range of this primary dichotomy must now be re-established. Gould unabashedly calls upon the great formalists of history to state their case, while he asks (late-)modern evolutionists to make the proper translation into (late-)modern terms. To drive this point home, Gould stresses the methodological point that for the great formalist Richard Owen, immediate utility may not imply "design" for a current end (Gould 2002, 326); complex shapes and anatomies—developed under formalist rules of structural transformation—after all, may find utility after arising for nonadaptive reasons. For example, the delayed fusion of mammalian skull bones may now serve as a prerequisite for parturition through a small birth canal, but birds and reptiles show a similar

delay, and this "adaptive" feature did not arise "for" its current and indispensable use in the mammal's case. Darwin struck a blow to the heart of Owen's system by substituting a flesh and blood ancestor, a concrete beastly thing, for the lovely, abstract, Platonic archetype of old.

Darwin reconfigured the abstract archetype into a *material* ancestor, thus converting Platonism to materialism; in his scribblings within the text of Richard Owen's *On the Nature of Limbs* (1849), in fact, Darwin wrote: "I look at Owen's archetypes as more than ideal, as a real representation as far as the most consummate skill and loftiest generalization can represent the parent form of the Vertebrata" (as cited in Ospovat 1981, 146). Effectively, Darwin inverted Owen's system, and the entire formalist program, by explaining the Platonic archetype in functional terms as a "congeries of past adaptations" materially inherited by descendants (Gould 2002, 329). Darwin practically mocked Owen's formalism, indeed, for Darwin used the "jargon" of the formalist-functionalist dichotomy—unity of type vs. conditions of existence—and then buried the formalist pole (along with Owen's most precious concept of the Platonic archetype) into the explicit functionalism of natural selection.

A major premise of Gould's *TSoET* holds that Darwin must be ranked in the functionalist line—for the causal mechanics of his theory grant such clear primacy to adaptation, however subtly the argument develops. But any evolutionary theory, in adding a "historical" dimension to reshape the simpler world of the formalist-functionalist dichotomy, would necessarily draw upon both axes of the old system to build the new, orthogonal dimension of temporal change. In two senses, formalist thought included great potential to influence Darwin's evolutionary views: first, and most obvious in its possibilities (though largely unrealized by Darwin), is classical

formalism, with its key concept of transformational channels within the bounds of archetypal design, followed a logic intrinsically favorable to a limited form of evolution, while the optimalist functionalism of Paley, or of Cuvier, rooted the impossibility of transmutation in the core of their central argument (Cuvier on correlation of parts, e.g.). Many of the leading pre-Darwinian formalists supported evolution in this restricted sense—Geoffroy in France, Owen in England. Yet, although Darwin could not have been isolated from this influence, I see no convincing evidence that his decision to embrace evolutionism derived from this source (cf. Gruber and Barrett 1974).

From the other side of the debate, Asa Gray understood Darwin's central contribution as the proper reintroduction of purpose (read teleology), or functionalism, into biology. In 1874 C.E., Gray wrote to *Nature* that Darwin had done great service for biology by "bringing back to it teleology; so that, instead of morphology vs. teleology, we shall have morphology wedded to teleology" (as quoted in Ospovat 1981, 148)—in other words, functionalist hegemony by proper criteria of primacy and relative frequency. Darwin appreciated the argument of Gray, apparently, for he wrote back to him: "What you say about teleology pleases me especially." As an aside, I wonder what of—and how much!—Darwin would appropriate this "teleology" in the (late-)modern context. But I reckon we will never know such an application, for we live without the intellectual force of (a?) Darwin today.

I assert that the content of Darwin's theory, from his earliest codification in 1838 C.E., stood clearly outside "formalist" thinking—both in replacing archetypes with flesh and blood ancestors built by adaptation, and in advocating the "functionalism" of natural selection itself.

Dov Ospovat (Ospovat 1981) presented the important thesis that Darwin's chief intellectual change within his theory of natural selection between codification in 1838 C.E. and its publication in 1859 C.E., lay in abandoning an original belief in perfect adaptation, and in accepting the crucial concepts of relative adaptation ("locally better than," i.e.) and imperfection imposed by constraints of phyletic history. This latter argument completed Darwin's rejection of Paleyan optimality, first by accepting evolution rather than God as the "architect" of morphology, and only later by recognizing that "history" implies imperfection in current design. I accept Ospovat's claim that this change must be interpreted as fundamental to the structure of Darwin's theory. Also, it is notable that Ospovat demonstrates that Owen's disparagement of teleology, and the veritably formalist notion of constraint imparted by archetypes and rules for their transformation, played an important role in Darwin's shift of attitude from a Paleyan optimality.

If Owen's formalism influenced Darwin in this manner, then why should Darwin be placed so firmly in the functionalist line? The first and most definitive answer must cite the obvious statement that Darwin explicitly so identified himself—in using the defining terms of the formalist-functionalist debate (i.e., unity of type vs. conditions of existence), and then in declaring his allegiance to the functionalist proposition as a "higher law" that subsumes unity of type as past adaptation. The theory of natural selection is functionalist, by Darwin's own recognition and definition, and by its routes (and roots) of causality inherent in its proposed mechanics. Intrinsic factors, for Darwin, supply copious, small-scale, isotropic variation—raw material only, with no direct cause or impetus of change—and evolutionary change occurs by

natural selection, as organisms adapt to modify and modified local environments. The mechanism of evolutionary change therefore remains functionalist in Darwin's theory: selection *powers* transformational change, and organisms adapt as a result. Darwin also defined his major problem squarely within the functionalist theme of adaptation, as he wrote, in the oft-quoted statement in the introduction to the *Origin* (Darwin 1859) that, from many sources much evidence could validate the factuality of evolution itself, but that "nevertheless, such a conclusion, even if well founded, would be unsatisfactory until it could be shown how the innumerable species inhabiting this world have been modified, so as to acquire that perfection of structure and coadaptation which most justly excites our admiration" (Darwin 1859, 3). Based on this assertion by Darwin, I contend that the argument from imperfection demonstrates the factuality of (macro-)evolution, but we biologists nevertheless need to explain adaptation more fully if they wish to understand the mechanism itself.

Darwin's concern with structural constraint cannot be denied (as his borrowed example from Owen surely indicates respect for and attention to this tradition of thought). Darwin linked the efficacy of natural selection to a set of assumptions about the nature of variation, but he could not be satisfied with such an abstraction, and he recognized that any complete theory required an understanding of the mechanisms of variation. Darwin thus presents his major discussion of constraint in fifth chapter of the *Origin*, titled "Laws of Variation"—for any exception to his trio of necessary properties for variation (copious, small in extent, and undirected) would compromise the exclusive power of natural selection by granting a role to "internal" principles of variation in the direction of evolutionary change. Any exception, in short, would represent a "law

of variation” acting not only as a source of raw material, but also as a subsidiary to natural selection among causes of change. In both the *Origin* (1859) and his extended treatise on *The Variation of Animals and Plants under Domestication* (1868), however, Darwin employed the phrase “laws of variation” to specify properties that could produce evolutionary change independent of natural selection. He proposed a threefold taxonomy of “use and disuse,” and “direct action of the external environment”—the bases of evolutionary theories often attributed to Lamarck and Geoffroy, respectively—and “correlation of growth” (or structural constraint), but Darwin viewed these mechanisms themselves as only useful auxiliaries or handmaidens to his preferred mechanism: i.e., natural selection.

For Darwin, only one category truly challenges the functionalist credo by embracing the primary structuralist theme of internal constraint upon adaptation, with consequential denial of functionality for certain features. Darwin names this category “correlations of growth,” and offers this definition of the concept:

> I mean by this expression that the whole organization is so tied together during its growth and development, that when slight variations in any one part occur, and are accumulated through natural selection, other parts become modified. This is a very important subject, most imperfectly understood (Darwin 1859, 143).

Note, even here, how Darwin defends the primacy of selection: natural selection builds a feature, and other features “follow,” so to speak, by correlational linkage to this generating cause. I contend that Darwin would probably be surprised, if he were alive today, of how prescient his remarks have proven to be, for in developmental biology, any small change occurring at the

onset of a process, cascades and ramifies various other changes as well, as a logical consequence of the primal change. That said, Darwin clearly defines correlation of growth as a category contrary to natural selection, for he explicitly excludes the common case of taxonomically correlated structures that arise by separate selection on each feature, with later joint propagation by simple inheritance (wings and beaks in birds, e.g.). He defines correlation of growth, on the other hand, as structurally forced association that is independent of immediate selection:

We may often falsely attribute to correlation of growth, structures which are common to whole groups of species, and which in truth are simply due to inheritance; for an ancient progenitor may have acquired through natural selection some one modification in structure, and, after thousands of generations, some other and independent modification; and these two modifications, having been transmitted to a whole group of descendants with diverse habits, would necessarily be thought to be correlated in some necessary manner (Darwin 1859, 146).

Not content yet, the concluding statement in chapter 5 of the *Origin* on “Laws of Variation” clearly expresses the domination of selection:

Whatever the cause may be of each slight difference in the offspring from their parents, and a cause for each must exist, it is the steady accumulation, through natural selection, of such differences, when beneficial to the individual, that gives rise to all the more important modifications of structure, by which the innumerable beings on the face of this earth are enabled to struggle with each other, and the best adapted to survive (Darwin 1859, 170).

Still further, in his 1868 C.E. title, *Variation of Animals and Plants*, with reference to indispensability of selection even in view of heritability, Darwin writes:

> Throughout this chapter and elsewhere I have spoken of selection as the paramount power, yet its action absolutely depends on what we in our ignorance call spontaneous or accidental variability. Let an architect be compelled to build an edifice with uncut stones, fallen from a precipice. The shape of each fragment may be called accidental; yet the shape of each has been determined by the force of gravity, the nature of the rock, and the slope of the precipice—events and circumstances, all of which depend on natural laws; but there is no relation between these laws and the purpose for which each fragment is used by the builder. In the same manner the variations of each creature are determined by fixed and immutable laws; but these bear no relation to the living structure which is slowly built up through the power of selection, whether this be natural or artificial selection. If our architect succeeded in rearing a noble edifice, using the rough wedge-shaped fragments for the arches, the longer stones for the lintels and so forth, we should admire his skill even in a higher degree than if he had used stones shaped for the purpose. So it is with selection, whether applied by man or by nature; for though variability is indispensably necessary, yet, when we look at some highly complex and excellently adapted organism, variability sinks to a quite subordinate position in importance in comparison with selection, in the same manner as the shape of each fragment used by our supposed architect is unimportant in comparison with his skill (1868, 2:248–49).

In this passage, I contend, the *Allmacht* of the later August Weismannian natural selection is profoundly foreshadowed. All components for the primacy of selection, and for the inconsequentiality of constraint (and other internal factors), flow together in this striking image

by Darwin. Indeed, selection may "depend" upon variation, but the character of variation hardly matters (so long as appropriate amounts and styles be present), given the ultimate power of selection; variation cannot be truly random, and we should not interest ourselves in its particular forms and biases. But, in the deepest sense, these preferred forms exert no influence upon the final "building" when selection (the architect) takes charge. Darwinian evolutionists—ever since Darwin, and especially since August Weismann subordinated all other factors to the *Allmacht* of natural selection—have placed too much confidence in this edifice. Darwin's metaphorical structure, fully shaped by the architect of natural selection, cannot be dismissed as a "house of cards," but the walls have developed some cracks and may even be ripe for a breach.

The Strength and Weaknesses of the Contingentist View

The strength of the contingentist view, in my opinion, lies in these three areas: (1) the "quirky" characteristic of most adaptations, that is, them being seemingly contrapted in an *ad hoc* manner; (2) that contingency rules the day in biological entities and systems, but because there are infinite galaxies for the complexification of matter to occur, our galaxy has stumbled upon a great example of the complexification of matter, which truly makes matter *matter*; and (3) that the fossil record, no matter how many times or whom might want to dismiss it, *is* data. Thus, things do not happen according to a divine plan. Instead of complexity and sentience developing by a divine plan that is forever decided before hand, there is always some semblance of absolute chance in the world, and thus at any time, an element of pure chance survives. The main weakness, in my opinion is the marked hubris that Gould sometimes exhibited in his writings. For example, in one of his later weekly contributions to *Natural History* magazine, Gould gives

us a dramatic example of this hubris in response to some criticism he had received regarding him noting the evidence for Precambrian divergences is devoid of meaning. Gould wrote the following:

> In fact, I don't see that it matters one whit … whether one worm-like species carrying the ancestry of all later animals, or ten similar worm-like species already representing the lineages of ten subsequent phyla, crossed this great divide from an earlier Precambrian history. The Cambrian explosion embodies a claim for a rapid spurt of anatomical innovation within the animal kingdom, not a statement about times of genealogical divergence. (1998b, 64)

Another weakness of Gould's work is that many times the same "solution" to a biological problem is repetitively "found" by the proverbial homing device known as natural selection. Indeed, in this chapter, we have seen that contingency—at the end of the day—rules the day, at all levels of biological existence. But is this truly the end of the evolutionary epic? Not at all. The phenomena of convergence, which a later chapter of this dissertation explicates (i.e., chapter 4), avers that the evolutionary epic—even though the "roads" and "paths" are varied and far more multifaceted than some allow—are more constrained in reality than ever admitted by Gould. In fact, not all things are possible, and indeed most "stuff" has occurred more than once. That is, they are convergent. This perspective is a needed corrective to the radical contingentist position promulgated by Gould. While my personal sympathies lie closer to Gould than Conway Morris, Conway Morris has some nearly indisputable evidence for the far-reaching implications provided by convergence theory qua contingency. I will explore them more fully in chapter four. I would

now like to take a small excursion into the concept and notion of “progress” in (macro-)evolutionary biology (i.e., chapter 3 in this dissertation). This seems to be the natural transition to this discussion, since the present chapter on Gould “touches” on progress so very frequently.

But first, allow me to recapitulate the import of Gould’s contentions to the overall theological thrust of argument in this dissertation. We have seen, for example, that Gould’s near-entire corpus is one long argument, as best exemplified in his *TSoET*, within which the ideas of (macro-)evolution and constraint receive enormous attention. We have further seen that Gould emphasizes the agency, efficacy, and scope of natural selection. Moreover, while Gould himself contends that he operates within a broad Darwinian context, nevertheless we have seen that he has revisions to Darwinism, primarily with his reference to his contention that the Duomo of Milan accurately pictures the state of Darwinism today, in that it has been added to and expanded time and time again, but rests upon the same structure with which it was initially founded.

We have also seen, for example, how Gould advocates for additional principles that augment Darwin’s original formulation, such as: exaptations and spandrels, mass extinction events, and punctuated equilibrium. I desire to highlight, in a theological frame of reference, how exaptations and spandrels gives credence to Peirce’s development of an original view of causation in that each act of it involves an efficient component, a final component, and a chance component (Peirce 1998, 115). As I illustrated at the onset of this chapter, according to Peirce, the efficient aspect of causation is that each event is produced by a previous event, whereas the teleological aspect is that each event is part of a chain of events with a definite tendency, and still

further the chance component of causation is that each event has some aspect that is determined by neither the efficient nor by the final cause. I contend that Gould's corpus gives ample demonstration of the God of chance, that is, the *tychism* (to be explained later in chapter 5) of Peirce's view in that exaptations and spandrels are "corralled," so to speak, by the supervenient general telos that God lays-out before all entities in the natural world. Moreover, punctuated equilibrium, in my reasoned opinion, illuminates the very instance(s) of involvement by the Spirit in the (macro-)evolutionary play.

Nevertheless, in what directly follows, I shall illuminate a contemporary philosopher of biology's stance upon the presence and persistent of "progress" in biological studies. This is a position with which I largely agree, it should be noted. The following chapter discusses none other than Michael Ruse's perspectives on progress. It is essential, in my opinion, to get further clarity about progress in the biological realm prior to proceeding to the next stage of this book. So then, without any further ado, let me broach a Rusean perspective on progress in the biological sciences.

Chapter 3: (Macro-)evolution, Darwin, and Progress from a Rusean Perspective

An Introduction to Michael Ruse, (Macro-)evolution, and Progress—The *Progressional* God

"I do think that progress has happened, although I find it hard to define precisely what I mean" (Maynard Smith 1992b). Michael Ruse is probably the most prolific and proficient writer in philosophy of biology in the contemporary era. He has quite a lot to proverbially say about the concept of progress in biology. For this reason, in this chapter, I will especially highlight Ruse's view(s) on progress in relation to (macro-)evolutionary biology. Also, Ruse's presentation is one with which I largely agree. Ruse's position will further "refine" the cluster of confusion generated in the previous chapter, as well, for Gould is at times incipiently inconsistent on the notion of "progress" in evolutionary studies. If Gould were inconsistent, though, Darwin himself was downright uninterpretable about the notion of "progress" in evolutionary studies. So then, in this chapter, I seek further clarity regarding this highly important theme in evolutionary studies by elucidating a distinctively Rusean perspective upon it.

This chapter adds to my overall argument in this dissertation by highlighting the back-and-forth of biology with regard to the concept of progress. It particularly defines, refines, and defends an overall position toward progress in biological systems that is largely *inconsistent* with the Modern Synthesis's breakage from progress. I build upon Darwin's dilemma with regard to the notion of progress in biology by stating his "problem" succinctly: i.e., the bare-bones mechanics of the theory of natural selection provides no rationale for progress because the theory addresses only adaptation to changing local environments. Species, then, now triumph because—in some sense difficult to define—the winners are "better" than the forms of life that they predate

upon or supersede. I hope that my readers can perceive the upward drive toward intensifications of sentience in and through this discussion of biological progress.

Synopsis of Position

Many modern and (late-)modern secular evolutionary biologists are reluctant to concede that Darwin was a progressionist, because they themselves reject the concept of progress as being too value laden, and there is a temptation to assume that the founder of the movement shared our own perception of the sentiment. However, progress as a symptom and expression of (macro-)evolution, will just not “go away.” The Christian Louis Agassiz contributes much to the Ruse’s view of progress, oddly. Indeed, Agassiz claimed that the unifying thread of all of reality, but especially of the earth, is that of progress: (1) from simple to complex; (2) from the uniform to the highly differentiated; and (3) from monad to man. Michael Ruse argues for a modern-day possible threefold parallelism, different in many respects to Agassiz but similar in making central the notion of progress; his is a parallelism between: (1) the development of society; (2) the development of science; and (3) the evolutionary development of organisms. According to Ruse, evolutionary biology is Heraclitean, that is, always moving. For Ruse, it also is true that the general progressivist view of science (biology) is one which has been widely accepted by commentators upon science. Ruse avers that the birth of the one idea (progress) brought about the birth of the other, that is, (macro-)evolution. Why progress, Ruse queries? In simple terms, it was because the more that was learned of the world of organisms, the more people realized that it is a world of change. There was, for example, an ever-growing dataset of biological phenomena that seemed to point to perpetual becoming rather than dormant being. Additionally, there was the fossil record with its revelation of yesterday’s organisms, of which there were no living counterparts. However, Ruse stipulates that between the years of 1930 C.E. and 1960 C.E.,

evolution separated from its proverbial parent, that is, progress. But the break has not been marked by finality, and therefore this break is not complete.

Brief Biography of Ruse

Michael Ruse was born in England in 1940 C.E., just after the fall of France and just before the Battle of Britain. Brought up as a Quaker, a religion where everyone—including the children—is expected to think things through for oneself, it was predetermined that he would become a philosopher, teacher and researcher. Ruse emigrated to Canada in 1962 C.E. and worked there at the University of Guelph in Ontario until 2000 C.E. when, having married one of his students and facing compulsory retirement with three teenagers still at home, he moved southward to Florida State University. He has recently retired from FSU, turning 80 years old and having taught for fifty-five years cumulatively. During this fifty-five-year timeframe, Ruse has written or edited over sixty books, founded and edited the journal *Philosophy and Biology*, and edited several book series, most recently the Cambridge University Press Elements Series in the Philosophy of Biology. Looking back, he declares, none of this compares to the joy of teaching, especially first-year undergraduates.

Ruse wrote his dissertation on philosophical problems in the biological sciences (accepted 1970 C.E.), a field virtually unplowed, and then—having published a short overview based on the dissertation, *The Philosophy of Biology* (1973)—moved towards the history of biology, writing a book with the self-explanatory title: *The Darwinian Revolution: Science Red in Tooth and Claw* (1979). Although he lost his faith at the age of twenty, Ruse was and still is interested in questions that relate to science and religion. It was therefore natural that he, in 1981 C.E., appeared for the ACLU as an expert witness in the State of Arkansas, in a successful attempt to show that a new law mandating the teaching of Genesis in biology classrooms was an

unconstitutional violation of the First Amendment. More recently, he has been writing and editing books on atheism especially, with the aim of showing that science and religion do not necessarily clash, and also writing books showing that often the controversies are a function of the way that scientists—evolutionists in particular—use their science as a secular religion. Little wonder that Believers get upset, then, he asserts.[1] Most recently, as his career draws to a close, his interests have reverted to those of his early years. Next spring, 2022 C.E., with Oxford University Press, he is publishing a book on hatred, war and prejudice. Ruse has always felt strongly that philosophy should never become just a technical discipline, turned-in on itself for professionals only. In his research, as in his teaching, he feels a strong moral obligation to both use and spread the fruits of philosophy for the interest and good of all.

The Fluctuating View(s) of Michael Ruse

Notably, Ruse was not always—seemingly—a progressionist; indeed, in his earlier texts, prior to the turn of the millennium, he was ever careful to distinguish between forms of progress, apparently attempting to employ a sort of verbal gymnastics (note: this is not a criticism, but is only reflective of Ruse's own struggles for an adequate vocabulary instead). He would openly speak of what he termed "comparative" progress, and "absolute" progress, or even "improvement," but only reluctantly affirmed what I term "objective" progress in evolutionary biology (Ruse 1993). He notes, particularly, that comparative progress is a Darwinian notion, centering on selection, and "at the microlevel, all would agree that it occurs" (Ruse 1993, 55). Ruse states, in fact, in one of his earlier texts the following:

> Progress that people desire, especially when (by and large) everyone has an interest in the end result, centers on value. Progress against some standard, which may or may not be

[1] Personal communication between Michael Ruse and I on 9 August, 2021.

> valued, centers on evaluation. We can think of them as *absolute* progress (or "progress" without qualification) and *comparative* progress. If one arrives at the Heavenly City, one has made absolute progress. If one makes a bigger and better atom bomb, one has made comparative progress. Although value judgments are required in both cases, it is the former which really interests us. Whether and how the latter will arise in our discussion is a question for the future (Ruse 1996, 20).

Controversy arises, Ruse says in his "Evolution and Progress" article, when one tries to take the hypotheses and findings of (micro-)evolution and apply them to the geological timescale, which is the concern of the (macro-)evolutionist (1993, 55). He goes on, asserting that two particular points of dispute exist: namely, over significant new adaptations—"innovations," as he terms them—and that over protracted shifts—what he terms, "trends" (1993, 56). Innovations open new ecological niches or the seizing of niches already occupied (see Nitecki 1990). In this process, an entity has an "adaptive breakthrough" (Ruse 1993, 56). Defining an "innovation" as something which has crossed a functional threshold, it has been claimed that they are the mainsprings of (macro-)evolution (see Jablonski and Bottjer 1990). Ruse argues that the history of the Darwinism movement can be understood only as an expression of the idea of social and anthropic progress. Indeed, he links the rise of evolutionism to the prevailing faith in the idea of progress. He believes, for instance, that the scientific credentials of Darwin's theory were never strong enough to convince anyone not predisposed to accept it on ideological grounds (see the entirety of Ruse 1996). Ruse also stresses the extent to which the founders of the Modern Synthesis (~1930 C.E. to ~1950 C.E.) still clung to the concept that *progression is philosophy*, which was so popular in the previous century. Indeed, Ruse is keen to point out that the idea of progress in biological advancement was not quick to disappear, persisting at least

until the Modern Synthesis in the middle of the twentieth-century (some would contend, myself included, that the notion still persists unto this day).

It is normally assumed that liberal theology saw individual effort (teams led by competition) as the driving force of progress. But as Desmond and Moore argue (1991, xii), there was a period in the early-nineteenth century when a less optimistic form of liberalism reigned, and Thomas Malthus's principle was part of Darwin's nonprogressive viewpoint. Darwin became part of the ideology of progress of only the later, more confident era of liberalism. Many modern and (late-)modern secular evolutionary biologists are reluctant to concede that Darwin was a progressionist, in part because they themselves reject the concept of progress as being too value laden, and there is a temptation to assume that the founder of the movement shared our own perception of the sentiment. Robert J. Richards (1992) accuses many historians of falling into this trap and thereby ignoring much evidence for Darwin's commitment to the idea of progress. Richards' interpretation fits well with Ruse's thesis on the more general link between biological evolutionism and progressionism. Most historians now accept that Darwin cannot be seen as a non-progressionist in the (late-)modern sense. Ruse argues that the evidence for evolution was never strong enough to persuade anyone by itself: people converted to Darwinism because it underpinned their faith in progress, and those who oppose the theory did so because they rejected that faith, perhaps on religious grounds (Ruse 1996, 179). As an aside, I ask: what has changed?

Following the Dominican priest biologist, Francisco J. Ayala—again, oddly!—one person who has made much effort with the notion of what I term "objective" progress in biology (see Ayala 1974, 339–54; Ayala 1982, 106–24; and Ayala 1988, 75–96), Ruse contends that the concept of progress requires change, and that this in some sense involves change in a linear

direction. As such, mere cyclical change could not qualify as progress, even though there is constant change in cyclical movements (see Ruse 1995, 110). But, "progress is more than just change… Progress implies that there is change in a certain *direction.* You must be going somewhere to have progress" (Ruse 1996, 19). However, according to Ruse, what is important is the recognition that directionality alone is not enough. Progress is a value notion—progress implies that things are in some sense getting better—at least, progress in any "absolute" sense has this implication. Going beyond Ayala, Ruse stipulates that it is useful to distinguish between evaluation and valuing (cf. the entirety of Nagel 1961). Only the latter is absolute, whereas the former occurs against any arbitrarily specified standard.

Contingency and Progress—Progress Defined, Refined and Defended

As I noted earlier, the Christian Louis Agassiz contributes much to the Ruse's view of progress. It may seem strange to start a chapter on progress in the biological sciences with an open and deliberate (even belligerent or pugnacious) theist, one who in many ways was a progenitor of the not-so-modern Creationist movement, but I will do so regardless, for his notion of progress serves as the foundation of Ruse's formulation of and response to the notion of progress. Indeed, the Swiss-American ichthyologist Jean Louis Rodolphe Agassiz (1807 C.E.–1873 C.E.) was a Christian paleontologist, who is often recognized as the proverbial father of glacial geology and the science of glaciology. More commonly known as Louis Agassiz, he proposed and argued for a threefold parallelism with respect to progress insomuch as the order of living beings, the ontogenetic development of individual organisms, and the history of life as seen in the fossil record all gave evidence to the notion of progress being exhibited in the natural (or in his case, "created") world. Indeed, claimed Agassiz, the unifying thread of all of reality, but especially of the earth, is that of progress: (1) from simple to complex; (2) from the uniform

to the highly differentiated; and (3) from monad to man.[2] Therefore, there is a *scala naturae*, all the way from invertebrates, to rodents, to primates, to mankind. For all of the problems with Agassiz's proposal, it had an influence far beyond what he envisioned (cf. the entirety of Bowler 1976). Michael Ruse argues for a modern-day possible threefold parallelism, different in many respects to Agassiz but similar in making central the notion of progress; his is a parallelism between: (1) the development of society; (2) the development of science; and (3) the evolutionary development of organisms (Ruse 1995, 109–35).

The Back-and-Forth of Biology

According to Ruse, evolutionary biology is Heraclitean, that is, always moving. No one would deny this, although, conversely, no one would deny that biology moves irregularly—now leaping forward, then equilibrating, and so forth (Ruse 1995, 114). But is there any meaning to the movement? Does the back-and-forth of biology make sense? Is there any pattern to it? Is biology progressive, and if it is, what is the nature of this progress and what is its cause? Speaking of scientists qua scientists—that is, excluding the things that scientists say when being self-reflective—they are strongly committed to the belief that their subject-matter both has a pattern and that it makes sense. In particular, biological scientists believe in progress (of science in general and biology in particular), and by progress they mean "getting closer to the truth" (Ruse 1995, 115; cf. Davies 1986). Moreover, scientists qua scientists are philosophical realists, and by "getting closer to the truth" they mean making their theories better correspond to the empirical facts (Ruse 1995, 115). For example, (late-)modern molecular genetics is, in a sense, "better" than Mendelian genetics because the unit of inheritance has been established as the near-particulate DNA molecule.

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[2] Interestingly, this last phrase serves as the basis of the title for one of Michael Ruse's most popular titles, *Monad to Man: The Concept of Progress in Evolutionary Biology* (1996).

For Ruse, it also is true that the general progressivist view of science (biology) is one which has been widely accepted by commentators upon science (see Losee 1972). At least, this is true of those closest to the philosophical end of the spectrum, although belief in scientific progress has come under attack from radical thinkers within historical, sociological, and literary disciplines (Ruse 1995, 115). The two most recent high-profile commentators on the nature of science (particularly biology) are—undeniably—Karl R. Popper (see Popper 1959, and Popper 1962) and Thomas S. Kuhn (see Kuhn 1962). As is well known, Popper believes that the mark of science—the "criterion of demarcation," in fact—is *falsifiability*, which means that science moves forward as scientists face problems, propose tentative solutions, and then others attempt to proverbially knock them down. Even in the process of refutation, however, progress is made, and the body of knowledge grows (see Popper 1972; Popper denies, however, that one can ever truly get to "the truth," per se).

Kuhn is at times read to be a non-realist, but Ruse contends that it is better perhaps to read him in a Kantian way: i.e., as seeing reality in an important sense defined and created by the inquiring mind (Ruse 1995, 117). Kuhn certainly does not see the aim and end of science as some kind of finished absolute knowledge, for there is always the possibility for another paradigm switch. Yet, in a passage which is often ignored—or, better yet: misunderstood—Kuhn, not much different than Popper, shows a virtual commitment to the notion of progress in science:

> The analogy that relates the evolution of organisms to the evolution of scientific ideas can easily be pushed too far. But with respect to the issues of [this book] it is very nearly perfect. The process described [by me] as the resolution of revolutions is the selection by conflict within the scientific community of the fittest way to practice future science. The

> net result of a sequence of such revolutionary selections, separated by periods of normal research, is the wonderfully adapted set of instruments we call modern scientific knowledge. Successive stages in that developmental process are marked by an increase in articulation and specialization. And the entire process may have occurred, as we now suppose biological evolution did, without benefit of a set goal, a permanent fixed scientific truth, of which each stage in the development of scientific knowledge is a better exemplar (Kuhn 1962, 172–73).

Interestingly, an endorsement of an "absolute" kind of progress—monad to man—can readily be found in rather recent secular evolutionary biological literature. For instance, entomologist and sociobiologist, Edward O. Wilson states:

> We should first note that social systems have originated repeatedly in one major group of organisms after another, achieving widely different degrees of specialization and complexity. Four groups occupy pinnacles high above the others: the colonial invertebrates, the social insects, the nonhuman mammals, and man (Wilson 1975, 379).

And then, he goes even further, in noting:

> The typical vertebrate society… favors individual and ingroup survival at the expense of societal integrity. Man has intensified these vertebrate traits while adding unique qualities of his own. In so doing he has achieved an extraordinary degree of cooperation with little or no sacrifice of personal survival and reproduction. Exactly how he alone has been able to cross to this fourth pinnacle, reversing the downward trend of social evolution in general, is the culminating mystery of all biology (Wilson 1975, 382).

Still further, Wilson is comfortable with the idea of "peaks" in evolution, commenting: "Four groups occupy pinnacles high above the others: the colonial invertebrates, the social insects, the

nonhuman mammals, and man. Each has basic qualities of social life unique to itself" (Wilson 1975, 379).

The most articulate expression of this general thrust has come rather recently from the pen of John T. Bonner (see Bonner 1987; cf. Benton 1987, 305–38), who argues that there has been and always will be a kind of biological pressure towards increase in bodily size, for bigness—as it were—has its virtues. For instance, when the early mammals retreated to the sea, the niches for small animals were overly crowded—but there was a plethora of room for *really* big animals. Hence the whales.[3] Continuing this theme, Bonner points out that the increases in bodily size requires a concurrent increase in size of internal support systems, which led to increased complexity, where this can be defined simply in terms of the different number of types of component parts. Complexity, in turn, led to improved selected-for adaptations, most importantly sophisticated social skills. So then, in Bonner's system, as in traditional accounts, primates—humans in particular—come out at the top of the heap again. As Ruse exclaims, progress reigns (again) (Ruse 1995, 122)!

Succinctly, one may confidently say that (macro-)evolutionary theory itself is a child of progress. Indeed, the belief that all organic beings have natural origins and are produced by the "normal" laws of nature was an idea that started to be accepted from the middle to the end of the eighteenth-century. Ruse claims that it was not by chance that evolution appeared at this time, nor was it by chance that the virtually same idea appeared in France, England and Germany along the same timeframe. After all, the eighteenth-century was one that invented, developed and promoted the idea of progress—i.e., the belief that it is possible to improve aspects of existence, and that this improvement can come about through human effort. Ruse avers that the birth of the

[3] In what may argue against my notion of objective progress, in the retreat to the sea, mammalian backbones underwent a significant simplification (see McShea 1991).

one idea (progress) brought about the birth of the other, (macro-)evolution (Ruse 1995, 140). Why progress, Ruse queries? In simple terms, it was because the more that was learned of the world of organisms, the more people realized that it is a world of change. There was, for example, an ever-growing dataset of biological phenomena that seemed to point to perpetual *becoming* rather than dormant *being*. Additionally, there was the fossil record with its revelation of yesterday's organisms, of which there were no living counterparts (see Bowler 1984, and Rudwick 1972). Combined with this, there was the traditional viewing of the organic world as a chain of being, going from the most-simple to the most-complex. Of course, as we know, this belief goes back at least to Aristotle's *De Anima*, and it was reinforced by theological and philosophical arguments throughout the Enlightenment (cf. Lovejoy 1936).

The Breakage from Progress

However, Ruse stipulates that between the years of 1930 C.E. and 1960 C.E., evolution separated from its proverbial parent, that is, progress. The "professionalizers of evolution" (also known as known as the "synthetic theorists") severed the bonds between the two. While (macro-)evolution had been capable of standing on its own two feet for nearly a hundred years, there was no reason for it to do so, so it failed to make the break (Ruse 1995, 147). Notable in his detestation and proverbial protest against this notion of progress in biology is George C. Williams, who points out that all standard measures of progress fail, and they even yield counter-intuitive results. For example, if one judges complexity over the whole of a life-span, a good case can be made for saying that the liver fluke is a higher life form than humans (Williams 1966). In fiat opposition to just about every progressionist mentioned above, Williams (1989) has recently argued that progress entails the dipolar opposite of that which is adaptively advantageous, because he feels (with T. H. Huxley) that that which is morally good is rarely if

ever that which is biologically good. Additionally, some more recent work, for instance on measures of complexity, simply shows what people like G. G. Simpson (himself a progressionist) said all along—namely, that there is simply no good reason to think that complexity is a *necessarily* ever-increasing product of the evolutionary process, and hence there is no reason to affirm progress in a Rusean "absolute" or what I term "objective" sense (cf. McShea 1991). So then, an accounting of secular evolutionists' views upon "progress" is a mixed bag, even today, in the early twenty-first century.

With regard to progress in (macro-)evolution, Charles Darwin is a mixed bag also. Purportedly, Darwin had no penchant for biological progress and rigorously excised it from his published writings (I am reminded of a cautionary statement from one of his notebooks on evolution: "never say higher or lower…"). For all intents and purposes, this was probably due to his mechanism of selection. In the arms race, what wins is what wins, insomuch as it could be the prize specimen which has all of the offspring, or it could equally be the foolish simpleton. As one who used to interpret Darwin this way, Ruse (1995, 120) currently believes that this story is admittedly alluring, but flat wrong (cf. Ospovat 1981). While it is true that Darwin recognized branching to be a crucial part of the evolutionary process, it is true also that Darwin denied any simple upwardly progressive force in evolution. Darwin saw that selection would lead to a kind of *relativistic* progress, whereby an entity improves *particular* adaptations, which could also be referred to as "comparative highness" (Ruse 1995, 120). But, in my opinion, it remains true that Darwin (1859) thought *relativistic* progress would morph into *absolute* progress, marked by the ever-pervasive rise of complexity. Curiously, Darwin saw humans—specifically Caucasian, male humans—at the proverbial top of the (macro-)evolutionary heap (Darwin 1871; see also Greene 1977).

In *The Vestiges of the Natural History of Creation* (1846), Robert Chambers—who was a prominent influence upon Darwin—regarded progress and evolution as part of the same proverbial family, with the former being the parent of the latter (Ruse 1995, 142). Darwin was also a progressionist about society. But how could he not be? After all, he came from a rich, liberal family, with roots deep in the industrial British Midlands. And this progressionism was taken explicitly into his biology. For progressionists like Darwin, there was an easy movement from belief in change in the world of culture and society (and science) to a belief in change in the world of organisms—a movement, that is, from "monad to man." And, especially given that the progressionists were keen to judge our own species as the epitome of "creation," it was natural to read the improvement of culture right into the processes and products of organic change. (Macro-)evolution was thus seen to be progressive, with Homo sapiens *sapiens* as the end point, at which stage people turned around and read the progressiveness of the (macro-)biological record back into society. Ruse stresses that whereas after the *Origin*, it was no longer necessary to appeal to progress to support one's belief in evolution, people nevertheless did (and still do; see Ruse 1995, 143). Indeed, Darwin provided what the earlier philosopher of science, William Whewell (1840), called a "consilience of inductions," thus making the support of progress unnecessary (Ruse 1975). In this sense, Ruse argues, evolution had grown up. Just like a human adult, it no longer needed its parent—societal progress—to exist, and yet, evolution did not leave "home," alike unto how many young adults do not leave home in the contemporary era when they "should" do so. (Macro-)evolutionists continued to be progressionists just as ardently after the *Origin* as they had before. Even more so, in fact.

Indeed, although Darwin attempted to caution himself to "never to speak of higher and lower," even in the first edition of the *Origin* (1859), there were strong allusions of Darwin's

own progressionism. This came through most clearly in the flowery paragraph, probably the most famous of all of the short snippets from the *Origin* (1859), which closes the volume:

Thus, from the war of nature, from famine and death, the most exalted object which we are capable of conceiving, namely, the production of the higher animals, directly follows. There is grandeur in this view of life, with its several powers, having been originally breathed into a few forms or into one; and that, whilst this planet has gone cycling on according to the fixed law of gravity, from so simple a beginning endless forms most beautiful and most wonderful have been, and are being, evolved (Darwin 1859, 490).

By the time of the third edition of the *Origin* (1861), Darwin's evolutionary ideas were a basic success, and thus he wrote candidly about his belief that evolution is essentially an "upward drive" towards humanity—especially, white European males (Peckham 1959, 222). Indeed, Darwin based his argument for a broad and general vector of progress in life's history, not upon the operation of natural selection (where he had explicitly denied such an outcome as the one of the most radical implications of his theory), but on subsidiary ecological claims for the predominance of biotic over abiotic competition, and for a geological history of plenitude in a persistently crowded ecological world, where one species must displace another to gain entry into ecosystems (the metaphor of the wedge). Darwin used these ecological ramifications, along with the gradualist and incrementalist logic of natural selection itself, as primary justifications for his essential claim of selection's scope—or the uniformitarian extension of small-scale (micro-)evolution in a smoothly continuationist manner—to explain all patterns of (macro-)evolution by the steady accumulation of increments through the immensity of geological time.

Concluding my selective survey of biological progress, I pronounce that it is apparent that the notion of progress continues to be of concern to evolutionists—especially those

interested in (macro-)evolution. Indeed, progress is alive and well in today's (macro-)evolutionary biology, with various scholars calling it an "arms race," an "escalation," the "Red Queen hypothesis," or what have you. At the same time, many (macro-)evolutionists feel distinctly uncomfortable in discussing the very notion, and there is a tendency to push such discussions into the semi-popular realm (see Maynard Smith 1992a). So, I return once more to Darwin.

Darwin's Dilemma (Again)

Darwin's dilemma can be stated easily: the bare-bones mechanics of the theory of natural selection provides no rationale for progress because the theory speaks only of adaptation to changing local environments. After all, the morphological degeneration of a parasite may enhance local adaptation for it just as surely as any intricate biomechanical improvement in a bird's wing for the bird. As such, Darwin (1903, 1:344) regarded the banishment of inherent progress as perhaps his greatest conceptual advance over previous evolutionary theories—and he said so, often and forcefully, as in this epistolary comment to the American progressionist paleontologist Alpheus Hyatt on 4 December 1872: "After long reflection I cannot avoid the conviction that no innate tendency to progressive development exists." For two reasons, Darwin could not find a rationale for progress in biotic and abiotic, physically-driven extinction and adaptation: (1) a non-directional path of environmental change can only elicit a set of meandering responses in the adaptive adjustments of organisms; and (2) the more serious challenge of catastrophe and mass extinction raises the possibility of randomness and death for reasons unrelated to the adaptive struggles of normal times—i.e., the wheel of fortune vs. the wedge of progress (see Gould 1989b, 14–21). Victory over other creatures in an intense and unrelenting struggle for limited resources permits a "small" inference about progress, however.

Species now triumph because, in some sense difficult to define, winners are "better" than the forms they vanquish or supersede. And the more uniformitarian the larger picture, the more that (macro-)evolutionary pattern arises as a simple summation of immediate struggles, so one gains increasing confidence that replacement and extinction must record the differential success of globally improved species. Thus, progress becomes an ecological concept for Darwin, and not a deduction from the inevitable mechanics of natural selection, but instead a mode of operation for natural selection in a particular kind of ecological world. If crowded habitats, where entities must struggle to the death for limited resources, represent an ecological norm on earth, and if geological change usually proceeds at a sufficiently stately and unobtrusive pace to permit the fruits of biotic competition to accumulate into patterns of origination and extinction through time, then one may understand why "organization on the whole has progressed" (Darwin 1859, 345). Darwin, however, links all his statements about progress firmly to his ecological theory of plenitude and to the prevalence of biotic competition.

On the other hand, Darwin was not prepared to abandon entirely his culture's central concern with progress, if only to respect a central metaphor that appealed so irresistibly to most of his contemporaries. In fact, Darwin penned other statements with equal assurance, as in the famous comment at the close of the *Origin*: "As natural selection works solely by and for the good of each being, all corporeal and mental endowments will tend to progress towards perfection" (Darwin 1859, 489). Both opinions appear prominently and often in Darwin's writing, but they simply do not go well with each other—i.e., they are ambivalent. This ambivalence on the question of progress highlights a broader issue at the center of Darwinism: amidst the various meanings of Lyell's "uniformitarianism," one concept has been judged as paramount by many scholars: i.e., "non-progressionism," or uniformity of state (this assertion

has been notably and nobly argued by Rudwick (1970). This proposition argues that the earth remains in a dynamic steady-state of constant, pulsating, cyclical change without direction. Did Darwin simply ignore this implication?

Darwin's most widely quoted statement about progress appears in the summary to his two geological chapters within the *Origin*. This famous passage also includes an odd mixture of firm conviction based on metaphors of competition ("the race for life" in this case), combined with some discomfort about the absence of a crisp definition:

The inhabitants of each successive period in the world's history have beaten their predecessors in the race for life, and are, in so far, higher in the scale of nature; and this may account for that vague yet ill-defined sentiment, felt by many paleontologists, that organization on the whole has progressed (Darwin 1859, 345).

Darwin goes on, "In the great scheme of nature, to that which has much, much will be given" (Darwin 1975, 248). In summary of Darwin's notion(s) on progress, one may say that in opposition to most of his evolutionary predecessors (Lamarck in particular), who postulated a higher realm of causality to encompass progress, Darwin stuck with his single level of immediately testable natural selection—and ensured progress by adding a boundary condition regarding the state of ecology, rather than by devising an additional and untestable causal apparatus. By doing such, Darwin managed to have a unified theory at a single level, and was also able to satiate his culture's hunger for general progress. Having his cake, so to speak, and eating it too.

Darwin owed a profound intellectual debt to Lyell, far more than the expropriation of a geological stage to support the play of natural selection. By transfer and analogy, Lyellian uniformity also provided a methodology for the general formulation and application of natural

selection itself. Lyell's view of change gave Darwin a framework not only for the obvious features of gradualism, incrementalism, and extrapolationism, but also for the less recognized ahistoricism of evolutionary mechanics. The bare-bones of natural selection supply no direction for the pathway of life: environments change in their non-directional manner, and organisms respond in a continuous dance of local adjustment. Darwin perceived that natural selection could not be accepted as a thoroughly sufficient theory of evolution unless this mechanism could also explain evidences of pattern in life's history. But how could Darwin meet such a requirement if natural selection—as a central attribute of its radical character—had been devised as a biological analog for Lyell's uniformity of state, or non-directionalism? This situation was Darwin's dilemma in its most abstract form—i.e., in the immediate context of his century, the concept of progress consumed nearly all discussion of the general subject of pattern. If Darwin could validate progress by natural selection, then he would solve his dilemma of how to extract directional pattern from an apparently ahistorical theory.

On Gould, Darwin, and the Concept of Progress—From a Rusean Lens[4]

By invoking the term (macro-)evolution, Gould means only the purely descriptive definition, a designation of evolutionary phenomenology from the origin of species up, in contrast with evolutionary change within populations of a single species, which is referred to as (micro-)evolution. In so doing, Gould follows Richard P. Goldschmidt's (1940) definitional preferences in the book that established his apostasy within the Modern Synthesis of evolutionary biology. Gould contends that misunderstanding arose because the domain of (macro-)evolution has historically implied a theoretical claim for distinct causes, particularly for nonstandard genetic mechanisms, that conflict with, or do not occur at, the (micro-)evolutionary

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[4] While I herein broach the concept of progress in (macro-)evolution from a fundamentally Rusean lens, for further expansion of this idea, please see my forthcoming volume on Ruse in particular (McCall, forthcoming-d).

level. Goldschmidt, however, urged a nonconfrontational definition that could stand as a neutral descriptor for a set of results that would then permit evolutionists to pose the tough question without prejudice: does (macro-)evolutionary phenomenology demand unique (macro-)evolutionary mechanics? Thus, in *TSoET*, (macro-)evolution is descriptive of higher-level phenomenology, and—this is critical to note, in my opinion—Gould does not present a pugnacious anti-Darwinian interpretation.

Darwin's theory of (macro-)evolution as expressed in his earth-shattering *On the Origin of Species* (1859), explicitly rejected and overturned the two evolutionary systems well known in Britain during his time: Lamarck's (1809)[5] (via Charles Lyell's exegesis in the *Principles of Geology*) and Robert Chambers' (in the anonymously printed *Vestiges of the Natural History of Creation* 1844). Darwin, in distancing himself from precursors as he refined his own theory in the years before 1859 C.E., usually drew a primary contrast with Lamarck, but he sometimes added the anonymous author of the *Vestiges of the Natural History of Creation* (known now to be written by the Scottish publisher Robert Chambers in 1844 C.E., though his authorship did not become officially known until the last edition of 1884 C.E., two years after Darwin's death), pairing "Mr. Vestiges" with Lamarck as the entirety of a background to be rejected. Notably, Darwin wrote to Joseph Dalton Hooker in an undated letter between 1849 C.E. and 1853 C.E.: "Lamarck… in his absurd though clever work has done the subject harm, as has Mr. Vestiges." Darwin then adds, in a moment of self-deprecation: "and, as (some future naturalist attempting the same speculations will perhaps say) has Mr. D." (Darwin 1887, 2:39).

Both of these visions—offered by Lamarck and Chambers—sunk a deep taproot in the most powerful of cultural biases by describing evolution as an interaction of two opposing

[5] His full name is Jean-Baptiste-Pierre-Antoine de Monet, chevalier de Lamarck. For brevity's sake, I will follow standard protocol in the sciences and refer to this man as Lamarck.

forces. The first—considered dominant, intrinsic and fundamental—yielded progress on the old theme of "the march from monad to man." The second force—designated as somewhat secondary, diversionary and superimposed—interrupted the upward flow and produced lateral dead-ends of specialized adaptations, from eyeless moles to long-necked giraffes. Darwin, in his greatest stroke of genius, took this so-called secondary force, proposed a new mechanism for its operation known as natural selection, and then redefined this former source for superficial "tinkering" as fully sufficient to render all of evolution, from molecules to men—thus branding the separate and more exalted force of progress as illusory. Or so the story goes, anyway. More about this later.

Notably, Gould believes that Lamarck had a far greater influence on Darwin than tradition has allowed (this is a point advanced as well by Corsi 1978, and by Mayr 1972). Gould does not claim, however, that Darwin devised natural selection as a conscious point-by-point contrast or refutation of Lamarck, but I suspect that Darwin clearly recognized what he did not like in Lamarck and thereafter strove to formulate a theory of opposite import and implications. While Darwin said little about Lamarck in his published works, we nevertheless know that he studied Lamarck intensely, and did not like what he read. Darwin owned a copy of the 1830 C.E. printing of Lamarck's *Philosophie zoologique*, and read the book while making heavy annotations at least twice (see Hull 1985, 802). Darwin's longest statement on this issue, a testy comment directed against Lyell's designation of Lamarck as a source for Darwin's own work, conveys insight into Darwin's rationale for rejecting Lamarck's hypothesis so firmly:

> Lastly, you refer repeatedly to my view as a modification of Lamarck's doctrine of development and progression. If this is your deliberate opinion there is nothing to be said, but it does not seem so to me. Plato, Buffon, my grandfather before Lamarck, and others,

> propounded the obvious view that if species were not created separately they must have descended from other species, and I can see nothing else in common between the "Origin" and Lamarck. I believe this way of putting the case is very injurious to its acceptance, as it implies necessary progression, and closely connects Wallace's and my views with what I consider, after two deliberate readings as a wretched book, and one from which (I well remember my surprise) I gained nothing. But I know you rank it higher, which is curious, as it did not in the least shake your belief. But enough, and more than enough. Please remember you have brought it down on yourself!! (Darwin 1887, 2:198–99).

Such an argument made by Darwin poses an obvious logical dilemma: how can such power be granted to a force formerly viewed as so inconsequential? After all, evolution must still construct the full pageant of life's history[6] and the entire taxonomic panorama, even if we abandon the linear order concept of progress. Darwin's answer reveals the depth of debt and psychological fealty that he had to Lyell, the man more responsible than any other for shaping Darwin's basic view of nature. Time—just time!—could produce nearly anything, provided that the formerly designated inconsequential force of adaptation worked without limit, thereby accumulating its miniscule effects through geological immensity of eras beyond measure. Though Darwin's evolutionary theory—and the extravagant richness thereof—cannot be exhausted by the common statement that Darwinism presents a biological version of the

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[6] The basic methodological problem of a historical science is that it aims, above all else, to understand causal processes; past processes cannot be observed in principle— therefore, we must learn about past instances of causation by making inferences from preserved results.

"uniformitarianism"[7] championed by Lyell for geology, a more accurate or more encompassing one-liner cannot be imagined.

In a revealing letter to Leonard Horner, written in or about 1844 C.E., Darwin exclaimed: "I always feel as if my books came half out of Lyell's brains… for I have always thought that the great merit of the Principles [of Geology], was that it altered the whole tone of one's mind and therefore that when seeing a thing never seen by Lyell, one yet saw it partially through his eyes" (Darwin 1987a, 3:55). Further, Darwin, who failed professionally as a geologist (the subject of his first three scientific books in the 1840s), embraced his mentor's doctrine of uniformitarianism as the core of his own philosophy as well, knowing that his revolutionary evolutionary theory would succeed only if he could show how natural selection might act as architect for the full panoply of life's history throughout geological time. Thus, Darwin attempted to generalize natural selection to the degree that Lyell had generalized uniformitarianism. As an aside, I heartily acknowledge my almost utter dependence upon Gould, and suspect that "half of my own thinking" comes out of the brains of Gould himself. This dependence, if you will, is clearly apparent in the pages of this dissertation, insomuch as if there is anything noteworthy contained in this dissertation, the reader can rest assured in knowing that it most likely came from Gould (originally), and is only "filtered" through my lens, that is, my particular operational context.

The uniformitarianism of his proverbial mentor—Charles Lyell—not only provided, by transfer into biology, a theory of evolutionary change. The doctrine of uniformity also supplied a world that could grant enough slow and continuous environmental change to fuel natural selection—but not so much that selection would be overcome, and the rein of pattern formation

[7] Uniformitarianism refers, generally, to the principle that the present is the key to the past. Thus, if one wants to understand how something occurred in bygone eras, simply look to similar processes in the contemporary era.

be seized by environment in its own right. In natural selection, the environment proposes and entities' dispose; this subtle balance of inside and outside must be maintained. But in a world of too much environmental change, the external component does not only propose, but can also dispose of entities and species without much feedback (see Gould 2002, 163). However, Darwin admitted that the natural selection mechanism made nothing, *per se*, but also deemed it to be creative (in a vernacular sense of the term) necessarily, as long as its action of differential preservation and death could be construed as the primary cause for imparting direction to the process of evolutionary change. Darwin reckoned that natural selection can only play such a role if evolution obeyed the following crucial conditions: (1) if nothing about the provision of raw materials—i.e., the source(s) of "variation" itself—imparts direction to evolutionary change; and (2) if change occurs by a long and insensible series of intermediary steps, each superintended by his proposed mechanism of natural selection—so that "creativity" or "direction" (read progress) can arise by the summation of individual increments. Under this vision, variation becomes raw material only—an isotropic sphere of potentiality about the modal form of a species. Natural selection, by superintending the differential preservation of a biased area from this sphere in each generation, and by summing up (over countless repetitions) the tiny changes produced in each episode, can manufacture substantial, directional change.

For Darwin, however, selection becomes creative only if it can impart direction to evolution by superintending the slow and steady accumulation of favored populational subsets from an isotropic pool of variation. The nomenclature of isotropy is a common term in mineralogy referring to the concept of a structure or system that exhibits no preferred pathway as a consequence of its construction, having equal properties in all directions. If gradualism does not accompany this process of change, selection must relinquish this creative role and strict

Darwinism then fails as a creative source of evolutionary novelty. Natural selection no longer causes evolution, and can only act as an eliminator of the unfit, promoting changes that originated in other ways (which, by the way, has been a constant point of criticism from non-Darwinians throughout the last nearly two centuries). Gradualism therefore becomes a logical consequence of the operation of natural selection in Darwin's creative mode. That said, however, natural selection, even in saltatory form, in my own opinion, would still enjoy a status far higher than that of a mere executioner. A new organ does not make a new species; and a new morphology must be brought into functional integration—a process that requires secondary adaptation and fine tuning, whatever the extent of the initial step, whether it be gradual or saltatory.

How can natural selection possibly be conceived as a "progressive," or "creative," or "positive" force of and within nature? In resolving this question, Darwin recognized his logical need, within the basic structure of his argument, to explicate the three main requirements and implications of an argument for selection's creativity: (1) the nature of variation; (2) the rate and continuity of change; and (3) the meaning of adaptation. This interrelated set of requirements promotes natural selection from mere existence as a genuine, but secondary and negative, mechanism to domination as the primary cause of evolutionary change and pattern. This last assertion makes a good segue to the next chapter of this book, number four, wherein I discuss Gould in dialogue with his opponents, primarily Simon Conway Morris. Why do I write such here and now? I assert that Conway Morris—in a totally duplicitous type of way—while intentioning to highlight the ever-present (Neo-?)platonic theory of forms, in part actually elevates natural selection. This elevation of natural selection, perhaps inadvertently, is because Conway Morris—seemingly—postulates that no matter what type of matter there is to work

with, it will eventually evolve into something that is convergent upon another something. Is this not also an elevation of natural selection's power and scope? I think it is.

But, before we go forward into a discussion of Conway Morris's contributions to this endeavor, allow me to reiterate why this chapter has been so important for the development of my overall position in this dissertation. This chapter adds to my overall argument by highlighting the back-and-forth of biology with regard to the concept of progress throughout the years since its gestation and birth. This chapter particularly defined, refined, and defended an overall position toward progress in biological systems that is largely *inconsistent* with the Modern Synthesis's breakage from progress. I then built upon Darwin's dilemma with regard to the notion of progress in biology by noting that while the bare-bones mechanics of the theory of natural selection provides no rationale for progress because the theory addresses only adaptation to changing local environments, nevertheless species now triumph because the winners are "better" than the forms of life that they predate upon or supersede. Further, I averred that it is apparent that the notion of progress continues to be of concern to evolutionists, especially those interested in (macro-)evolution. Indeed, progress is alive and well in today's (macro-)evolutionary biology, with various scholars referring to it by other monikers, such as: the "arms race," an "escalation," or the "Red Queen hypothesis." In sum, it is my hope that my readers can perceive the upward drive toward intensifications of sentience in and through this chapter's discussion of biological progress.

Chapter 4: Gould in Dialogue with Opponents—Structuralist Defiance

An Introduction to Simon Conway Morris—The *Convergent* God

Conway Morris, whether it be either intentionally or unintentionally, actually reinforces the dominance of Darwinian adaptation in and through his writings. While I do not agree with the Neoplatonic overlay by him upon his "discoveries," I nonetheless can build upon his implicit elevation of natural selection to its (rightful?) place of dominance. In this sense, then, Conway Morris chastens Gould's hypothesizing about contingency in (macro-)evolution, along with all that contingency directly entails. As stipulated at the onset of this dissertation, I will work toward a quasi-synthesis of these two figures in evolutionary biology and paleontology. In so doing, I take from Conway Morris that no entity can escape its history insomuch as all present-day entities must work with what they have been proverbially given from their contingent ancestors. However, through both the constraints of natural systems and the mechanism of convergence itself, while the paths toward the derivation of intensifications of sentience are markedly varied, the destinations, so to speak, are few.

Synopsis of Position

In the present chapter, I will argue that ontological randomness is genuine. God does not determine the outcome of every scientifically random event, but instead constrains randomness by setting broad boundaries, such as the range of possible outcomes of a random event and the probability of each outcome. God then allows particles, systems, and organisms to interact according to natural laws within these boundaries, producing a wide range of beautiful and complex results. So then, we live in a world of chance and randomness. As such, things do not happen according to a divine plan. Rather, there is always some semblance of absolute chance in the world, and thus at any time, an element of pure chance survives.

But how much is truly chancy and random? This chapter looks at how, through paleontological examination, randomness and chance—which are inextricably linked—shape the world from the bottom up (see Sweetman 2015, 110). Brendan Sweetman (2015, 113), who argues explicitly for determinism, even admits that this definition of randomness works well within the discipline of biology. I disagree with Sweetman (2015, 113), one may surmise, when he further stipulates the "simple fact that it is not true that the cause (or more accurately causes) of any event in the universe could have been different than they in fact were… In short, we are looking at a completely deterministic universe." But, aping Paul Harvey—the famous national radio host of yesteryears—we need to know the "rest of the story" as well, which may or may not accommodate (some of) Sweetman's contentions. Let us, then, proceed forward.

Brief Biography of Conway Morris

Simon Conway Morris was born in 1951 C.E. and raised in London. In 1972 C.E. he received his BSc degree with first class honors in geology from the University of Bristol. Elected fellow of St. John's College in 1975 C.E., he received his PhD in 1976 C.E. from the University of Cambridge. In 1979 C.E. he was appointed lecturer in the Department of Earth Sciences at The Open University. Four years later, Conway Morris was appointed lecturer in the Department of Earth Sciences of the University of Cambridge. He was further appointed reader in evolutionary paleobiology in 1991 C.E.; and in 1995 C.E. he was elected to an *ad hominem* chair in evolutionary paleobiology at the University of Cambridge, UK.

While he is best known for work on the Cambrian explosion, especially as related to Burgess Shale fossil fauna, more recently he has been interested in evolutionary convergence. Conway Morris has engaged in public debate, arguing against intelligent design on the one hand, and against materialism on the other for years. Since 2005 C.E., Conway Morris has been

involved in the Cambridge-Templeton Consortium, a $5.5 million project funded by the John Templeton Foundation to encourage scientific research relevant to the continuing debate over the purpose of emerging biological complexity. This fact, I think, will become more relevant in what follows.

The Evolving Views of Conway Morris

Approximately 520 MyA (million years ago), in the Cambrian sea, there swam a bizarre array of animals. For example, there was *Opabinia*, which carried on its "head" a cluster of "eyes" (well, at least proto-eye "spots"), not to mention a huge "sucker" of unknown utility on its anterior axis. There was also a species named *Anomalocaris*, which was a baby shark-sized swimming creature, equipped with a set of, presumably, two strange grasping "arms"—these "arms" were jointed like those of a lobster, but these creatures had a body as slick as a squid, which left the "arms" apparently weirdly flapping along its side. What, then, could these "arms" have done? I know not, but these were oddball animals, to be sure. There were also apparent worms with scales as dense as the mane on a contemporary chicken. Oddest of all of the oddities, however, was undoubtedly *Hallucigenia*—these small, spindly, and spiky "things" apparently possessed tubular organs, as well as what may or may not have been a formal "head."

So then, the Cambrian ocean swarmed with sea-going arthropods: jointed-legged animals, alike unto lobsters and lice, along with organisms alike unto spiders and scorpions. As aforementioned in the above chapter concerning Gould, Charles Doolittle Walcott dubbed the most common of these Cambrian creatures "lace crabs": i.e., creatures as delicate as a bird's feathers, but crested in a way unlike any contemporary shrimp. Alongside these animals, there were marine-like crustaceans. Additionally, there were (at least) a dozen more puzzling and peculiar species, like *Sidneya inexpectans* or *Waptia*. These strange creatures composed the

"world" of the Burgess Shale (notably, all of these creatures are known only from fossils preserved as subtle, silvery-looking films laid out on slabs of dark shale). All of these Latin names—*Hallucigenia, Anomalocaris, Sidneya inexpectans*—describe the shock-like emotions of the original describers after perusing them; indeed, these animals were unexpected, anomalous, and hallucinatory.

Conway Morris is concerned precisely by the lack of predictability in biology, particularly in evolutionary biology—i.e., the assumptions that contingency reigns supreme and the outcome of the ages is left to random events. He himself had a similar view during his early career in the late 1970s and early 1980s, digging-out Cambrian fossils from the Burgess Shale, which were a bizarre series of fantastic-looking early animals. Most of them were interpreted as precursors of branches in the tree of life that were dead-ends or were cut short in the early history of animals. Conway Morris, for example, seemingly at every symposium he presented at during the late 1970s and the early 1980s, threw out the "red-meat" of some new oddity from among the "worms"—as they were then classified—of the Burgess Shale. In fact, it was Conway Morris who pioneered the idea that the animals in the Burgess Shale fauna might include "failed" (macro-)evolutionary experiments—forms or designs that never prospered in real-life—in his early seminal papers on the topic. Gould seized upon that idea—i.e., that the Burgess Shale is a demonstration that history might have been different if one, rather than another, animal had prospered. Who knows (?), had *Hallucigenia* been an overly fecund progenitor, maybe Homo sapiens *sapiens*, or even sentient creatures in general for that matter, would in fact never have arisen. It was therefore possible, at least for Gould, to view life's subsequent history as a *loss* of potential, a veritable diminution in the variety of its possible architecture(s). Indeed, had an accident eliminated one of these early ancestors of the branch that led to Homo species, we

would not be here! Famously, Gould proposed that if we were "to rewind the tape of life" and "replay" it, intelligent, sentient, and self-conscious beings would not be found in this alternative world. So then, Gould (1989c) arrived at the conclusion that history was strictly dominated by contingency.

Changes since Gould's *Wonderful Life*

Something has happened since 1989 C.E., however. In the late twentieth-century, the tide started to turn, and more work on Cambrian fossils from other large deposits of fossils (e.g., China, Greenland) challenged the view that many of these early animals belonged to groups (*phyla*) unrelated to anything that evolved later. In some cases, researchers found that these early animals were—after all!—related to animals still remaining in the fauna located around us contemporary Homo sapiens *sapiens*. Given the importance of the Cambrian explosion in the evolution of animals, and the amount of work Conway Morris has done on it, a book on the topic from Conway Morris was assuredly guaranteed. So then, nearly ten years after Gould's *Wonderful Life* (1989c) appeared, another book made an even more explosive entrance into this arena. This time, however, it was written by the "star" of the original story—and the hero of Gould's Cambrian worldview—Simon Conway Morris. In the years since Gould wrote of the significance of the Burgess Shale (1989 C.E.), Conway Morris had plenty of opportunity for "second thoughts," so to speak, and perhaps even to "stew" in some form of frustration or anger. Conway Morris's revised view at this time (ca. 1998 C.E.) is apparently like a rather defused "explosion." Conway Morris is not motivated solely by a desire to tell the world about the wonders of the Burgess Shale; his book is largely a direct response to Gould's *Wonderful Life* (1989c). It might have taken him nine years to get his response out in print, but *The Crucible of Creation* (1998) is nevertheless a direct reply to Gould. Conway Morris finds (quite) a lot to

disagree with in regards to Gould's *Wonderful Life* (1989c). At one point, he even manages to find grounds for a dispute before the Burgess Shale comes over the geological horizon!

About 520 MyA, our modern fossil record began with the greatest of geological bangs—the Cambrian explosion. Within a few million years, nearly all major groups of invertebrates with hard parts made their first appearance in the fossil record. For fully three billion years before, life had included little more than a long sequence of bacteria and blue-green algae. But the fossil record of early life does include one important exception—first discovered in Australia but now known throughout the world—that is, the Ediacaran fauna. In rocks just predating the Cambrian explosion, we find a moderately diverse assemblage of medium to large (up to a meter in length), soft-bodied, shallow-water marine invertebrates. Adolf Seilacher, then-professor of geology at Tübingen in Germany, found these little invertebrates, and they were immediately cast (by others) as precursors to jellyfish, corals, and worms.

Not so fast, says Seilacher. Seilacher contended that these little invertebrates were "failed experiments" in the long march toward life (1984, 159–68). Indeed, Seilacher stated that the Ediacaran fauna contains no ancestors for modern organisms, and that every Ediacaran animal shares a basic mode of organization quite distinct from the architecture of living groups—i.e., the Ediacaran animals evolved before any creature had invented mineralized skeletons or external hard parts. The entire Ediacaran fauna, in other words, represents a unique and extinct experiment in the basic construction of living things. Our planet's first fauna—the Ediacaran—was entirely replaced after a mass extinction, not simply improved and expanded. Whereas Gould endorses Seilacher's view that the prior Ediacaran fauna was a "failed experiment" in the history of life—an evolutionary dead-end, one might say—Conway Morris makes the case that Ediacaran animals, or at least their descendants, are alive and well in the Cambrian—and some

even today too, as cnidarians. So here, too, is another “friendly” disagreement between Gould and Conway Morris. Humorously, at least to me, Conway Morris is highly critical (if that even be the word!) of Gould in his *The Crucible of Creation* (1998), and I would like to quote Conway Morris to illustrate the point that there is no love lost between Conway Morris and Gould:

> Again and again Gould has been seen to charge into battle, sometimes hardly visible in the struggling mass. Strangely immune to seemingly lethal lunges he finally re-emerges. Eventually the dust and confusion die down. Gould announces to the awestruck onlookers that our present understanding of evolutionary processes is dangerously deficient and the theory is perhaps in its death throes. We look beyond the exponent of doom, and there standing in the sunlight is the edifice of evolutionary theory, little changed” (Conway Morris 1998, 10).

All of the above quote is a rather “gassy way” of saying that Gould is a… “mountebank,” according to Richard A. Fortey (2000, 141).

Conway Morris had still other verbal explosions reserved for Gould. Indeed, Fortey recounts the following statement in his *Trilobite* (2000)—made by Conway Morris—regarding the vitriol he felt toward Gould, apparently around the time or a few months after, Gould initially released *Wonderful Life* in 1989 C.E. Conway Morris reportedly states, “I have never encountered such spleen in a book by a professional; I was taken aback. Gould doesn’t write… he produces ‘perorations’,” meaning that Gould truly lacks originality, while laying claim to it (Fortey 2000, 143). Conway Morris and Gould themselves subsequently “slugged it out” in the pages of the *Natural History* magazine near the turn of the twenty-first century. Some people

may think that such disputes are part of the “hype” to increase book sales, but such antipathy *cannot* be faked. Conway Morris simply did not like Gould—at all.

It seems to me that the cause of Conway Morris’s ire was the very praise that Gould once granted to Conway Morris. Gould’s *Wonderful Life* (1989c) was a highly valued, global success. Preserved in the print of a book that could never be unprinted (and probably has not been out of print since its initial publication…), was the Conway Morris statement of “oh f***! not another new phylum!” in reference to his laboratory work on the Burgess Shale fauna in the early 1980s. That is a representation of the Conway Morris of the early 1980s, but the “new” (“redeemed”?) Conway Morris simply did not like that reminder of his former self and views. Conway Morris has conducted, therefore, an extraordinary revision of history. Thus, the cause of Conway Morris’s explosion was *not* envy of Gould, but resentment of the views that Conway Morris himself once held in the past instead. However, most any reader of *The Crucible of Creation* (1998), unaware of the history that Gould recorded in print, would hardly understand that Conway Morris’s views were once nearly—if not exactly—like Gould’s (1989c). Also, this imaginary reader would never conceive of the notion that Conway Morris once received the Schuchert Medal of the Paleontological Society of America in 1991 C.E., the most prestigious honor in the field, *with* Gould’s approval.

Purportedly, the inventor of the assembly line for automobiles, Henry Ford, once quipped that “History is bunk!” Apparently, Conway Morris would agree with such a sentiment. But not Gould: he instead makes “history” the cornerstone of his pontifications—is that not truly the task of a historical science like paleontology? I contend it is. So then, Mr. Ford, “history” is not “bunk,” but rather the means through which we understand the present. This doesn’t mean that “uniformitarianism” is correct in its appropriation, however. But it is still the case that

"history"—which includes the (macro-)evolutionary advance—is our only guide to the past, through reconstruction according to the best of our abilities. For better or for worse, (macro-)evolutionary biology is as much historical as is astronomy, for example, but perhaps with looser laws and more diverse objectives. If history is bunk, then (macro-)evolutionary studies are worse than meaningless. I reject that outright.

Conway Morris's *The Crucible of Creation* (1998) and *Life's Solution* (2003)

Nevertheless, Conway Morris himself took on Gould's (1989c) views in his book *The Crucible of Creation* (1998), the fundamental points of which were later expanded in *Life's Solution: Inevitable Humans in a Lonely Universe* (2003). I'd like to begin by discussing minimally *The Crucible of Creation* (1998). In it, Conway Morris has produced another account of the Burgess Shale creatures, explaining to a wide audience the significance of new discoveries and new interpretations that have emerged since Gould wrote his tome in 1989 C.E. It may appear that this is just another "coffee-table book" about the strange animals in the Burgess Shale fauna. But make no mistake: it is a full-scale assault on Gould's interpretation of the Cambrian explosion and on the philosophy of life embodied in that interpretation. Conway Morris wants to convince us that we humans (or sentient beings very much like us) are the unique, yet "intended" goal of evolution. The word "creation," therefore, in *The Crucible of Creation* (1998), is not to be taken lightly, in my humble opinion.

Like Gould's *Wonderful Life* (1989c), Conway Morris's first book takes us through the story of Charles Doolittle Walcott's discovery of the Burgess Shale and his efforts to describe the animals revealed by the high level of preservation in this very special (but as now known, by no means unique) location in the Canadian Rockies. Admittedly, it seems, Walcott was Gould's anti-hero, the paleontologist who "shoehorned" a whole range of bizarre Cambrian types into a

few known categories, most of which were arthropods. Gould's most evident complaint was that Walcott was blind to the obvious "weirdness" of the Burgess Shale creatures because he was committed to the orthodox view that the cone of evolutionary diversity must needs expand through time, and that invariably so. In my opinion, Conway Morris, at least to some extent, rehabilitates Walcott's reputation by showing that the disparity of Cambrian lifeforms was not (quite) as extensive as Gould claims. To establish this point, Conway Morris gives us a fascinating tour through the research that has transformed our understanding of the Burgess Shale entities in *The Crucible of Creation* (1998), revealing that the above-mentioned strangeness is often only "skin deep," so to speak, concealing in fact underlying features that confirm their position within, or between, known *phyla*. Conway Morris bases his "correction," of sorts, of Gould partly on the arising of developmental genetics to the forefront of the biological map in the late twentieth-century. However, that topic is a "black-box," I contend.

Indeed, I remember distinctly how in my advanced developmental genetics course (ca. Spring, 2000 C.E.), we learned that the various hox genes and the pax6 genes are somewhat "universal." In one species the hox gene family (well, really their protein products) regulates the formation of buttocks (this is a nice manner of saying anal cavity), for example, as in humans. But in another species, it may very well regulate the formation of a stinger, for example, as in a wasp. These are intentionally simplified examples, but they serve to make the point I wish to express. At most, the hox family of genes can only be generalized around the posterior or anterior axis of a species. What this family of genes actually "forms" or "does" depends on the particular species in question. Further, the pax6 gene product produces compound-like eyes in insects, but it produces camera-like eyes in Homo sapiens *sapiens*. So then, what really does this invocation of developmental genetics illustrate?

I also distinctly recollect and can testify to the unusual results of rearranging genes in genomes, for I inserted transgenic DNA into upland cotton genomes at Emergent Genetics, Inc. at the turn of the millennium. In so doing, we oft incurred cotton leaves out of position (note that most land plants, besides maybe an outlier or two, have "determined" expressions of phyllotaxis—i.e., leaf placement along the stem). Not only did we at Emergent Genetics have the result of strange phyllotaxis, but also other strange patterns of bud and stem placement in upland cotton species that we "tinkered" with in the laboratory. So in truth, the developmental biology addition to the (macro-)evolution discussion only obfuscates issues more-so. This is because the same gene products (i.e., proteins) produce such drastically different "stuff" in disparate species.

However, Conway Morris also considers in *The Crucible of Creation* (1998) discoveries from similar sites in Greenland and China that have also thrown light on the Cambrian fauna from the Burgess Shale. The climax of Conway Morris's *The Crucible of Creation* (1998) is an idiosyncratic imaginary tour of the Cambrian seas via a time machine, with detailed descriptions of the structures and habits of the various species as then understood, which includes some fascinating imaginary color plates to demonstrate what the full organisms may have looked like in real life. Is this all just imaginary, though? I for one am *not* convinced that it is not. After all, many assumptions are made in the re-construction of these color plates, which are influenced by Conway Morris's own biases and influences. How can they therefore be taken as any more credible than Gould's own fanciful re-constructions of the same evidence? Is not one just as prejudiced as the other?

The concluding chapters of *The Crucible of Creation* (1998) survey the theoretical significance of the new interpretations on the old evidence. Conway Morris is imaginative in his own right by explaining how and why the Cambrian explosion took place in the first place. He

constructs a theory that combines genetic triggers for structural innovations with an ecological pressure generated by the origination of predators in the newly formed Cambrian landscape. Conway Morris's real concern, though—it seems to me—is to utterly refute the Gouldian claim that the explosion requires the postulation of evolutionary forces that are no longer in operation. So then, the main plank of Conway Morris's argument is the denial of Gould's alleged primary disparity of form. Using his version of cladistic analysis, Conway Morris argues that the Burgess Shale creatures can all be fitted either into known *phyla*, or intermediate states that somewhat illuminate the process by which the known *phyla* diverged from one another. If that be the case, then what?

Sidnie Manton's Arthropodic "Eve"

Conway Morris notes that Harry Whittington and Derek Briggs, the Cambridge paleontologists who re-discovered the Burgess shale species with himself, and then made the first distinctly modern studies of the Burgess Shale species, were highly influenced by Sidnie Manton's (1978) thesis that the arthropods are polyphyletic. According to Manton, then, there was no arthropodic "Eve," that is, no *single* ancestor from which all modern arthropods are descended. The chelicerates (spiders and scorpions), crustaceans (crabs and prawns), uniramians (insects) and the extinct trilobites—each—independently evolved the characteristically classic arthropod structure. On such a Mantonian model, it would not be surprising that some other, equally independent, arthropod types might have appeared in the Cambrian and then become extinct. Contemporary studies, however, have intimated that (most) all of the Burgess Shale arthropods can be accommodated within a scheme that explains their origin in monophyletic terms—i.e., from a single common ancestor in which the basic arthropod structure itself was developed. Meanwhile, *Wiwaxia* (from the Burgess shale) and the halkieriids (from Greenland)

show how the mollusks and brachiopods evolved from the annelid worms. Major transformations are involved, of course, but it seems that nothing in these transformations require the postulation of evolutionary forces outside the range of what can be studied in contemporary times, which of course, is a direct refutation of Gould's postulation of the unique circumstances surrounding the Burgess Shale fauna. Or is it?

Gould's Claims Refuted?

Conway Morris thus claims in *The Crucible of Creation* (1998) that Gould's scenario presented in his *Wonderful Life* (1989c) for the origin of animals is disproven because there was *no* vast radiation and *no* winnowing-out of the early *phyla* by extinction. But the disagreement between the two paleontologists is more fundamental than this assertion in and of itself: Conway Morris contends that Gould's whole "rerunning-the-tape" scenario is misleading if Gould intends to imply that the outcome could be significantly different from what we observe in this present milieu. While Conway Morris states that he does not want to imply that evolution is directed by mysterious goal-directed forces, that is a possibility for Conway Morris's scenario, it seems to me. However, Conway Morris appeals, instead, to the concept of convergence in order to argue that at least in broad outlines, the outcome of evolution is predetermined—by W/who or by what is, it seems, at least in 1998 C.E.'s *The Crucible of Creation* unclear, *per se*. Although, with his titling of the brief to include "Creation," Conway Morris is apparently not opposed to a theological overlay upon his work. At least, that is my take, anyway. Nevertheless, in Conway Morris' *The Crucible of Creation* (1998), convergence is stipulated to occur when two lines of evolution independently develop the same or very similar structures, as when ichthyosaurs (reptiles) and whales (mammals) presumably independently evolved a fish-like body plan. This phenomenon of convergence occurs because certain structures are simply *the best* for certain

(adaptive) purposes—thus, any vertebrate that proceeds to swim in water is going to evolve in the same direction—again, presumably. Conway Morris argues in *The Crucible of Creation* (1998) that the combined limitations of the developmental pathways triggered by genetics and the demands of the environment combine together to instantiate only a few possible outcomes of the evolutionary process. These possible outcomes, then, are very limited in number. While one can conceive of all sorts of different creatures imaginatively, they could never exist in the real world. Further, what can exist, according to Conway Morris, is pretty-much confined to what we actually perceive in the "real" world. So then, for Conway Morris, "re-running the tape" of evolution would produce more or less the same results, although the details might be slightly different. Thus, for example, there would be something akin to whales swimming in the contemporary sea environment, although they might have evolved from different mammalian ancestors than they in fact did (in this dispensation).

Conway Morris also combined the scientific discussion with a more philosophical discussion on what implications these ideas had (for him, anyway). For him, the fact that certain "solutions" are found again and again points to the existence of ecological niches, with certain features constrained by the environmental circumstances, that sooner or later are occupied by one lineage or another. As Gould (1989c) did before, Conway Morris (1998) also speculates about the implications for the existence of a sentient, self-conscious intelligent life form. For him, this is also a niche that has always been waiting to be occupied, which clearly demonstrates his assumption of and advocation of a (Neo?)-Platonic realm of forms. In this regard, once life started, we sentient humans are not an accident of evolution, but an inevitability of evolution. Conway Morris notes that in the evolutionary phenomena of convergence, although almost always thoroughly accepted in conventional evolutionary theory, convergence has not been given

the attention that it deserved. In convergence, similar patterns appear in widely divergent groups, and Conway Morris has employed examples of convergence to argue that despite apparent contingency, evolution is far more predictable than admitted by Gould. Indeed, Conway Morris indicates that evolution through natural selection may proceed along various paths, but the destinations are few. So then, there is a dichotomy: randomness is constrained within pattern. Constraint in evolution is central in determining what might never be possible as against the very likely, perhaps even inevitable. In fact, Conway Morris (2015, 31) contends that when one looks at either the functionality of biological solutions or the roads taken in evolution, the choices are indeed restricted, if not inevitable. Even so, as far as we know, we still have no evidence of other life forms apart from those on Earth—which implicates that the origin of life is the real bottleneck in evolutionary history, even if, as Conway Morris everywhere asserts, this was a completely natural origin.

The "Search Engine" of Evolution

Once life starts moving on, according to Conway Morris, the forces of natural laws both push and constrain it to paths across a biological landscape that could reach, not unexpectedly, to the development of an intelligent and sentient being that would occupy a mental niche (but that does not mean that these beings had to be necessarily Homo sapiens *sapiens*). As Conway Morris' ideas have developed in recent years, he prefers the view of evolution as a "search engine" of sorts that explores the opportunities of life and, rather than just emerging in a pre-existent mental world, discovers it after navigating a constrained "hyperspace" of biological possibilities. We humans could be the first to set foot on this new landscape, but it does not mean that we are entirely unique. As he indicates, the intelligence of other runners in this race of discovery, like corvids, dolphins and great apes, suggests that equivalent "search engines" are

only a few million years behind Homo sapiens *sapiens.* It should also be mentioned that, in our own human family tree, other branches have also already arrived even closer to us (Neanderthals, Denisovans, Flores "hobbits," etc.). Of course, this is to fully embrace a sort of Platonic idealism—one that he does not hide.

The convergence hypothesis is important because it is central to the study of evolution due to its confirmation of the power of adaptation acting upon historical contingencies. It brings into focus the tension that is present within the rule of organization for any entity and the radical contingency of historical pathways in the paleontological record (Conway Morris, *Runes*, 5). Convergence is ubiquitous across the scale of life. Although the number of possibilities in evolution is more than astronomical, the ones that actually work are merely a small subset of the potential number (Conway Morris 2015, 21). Convergence, in sum, opens up new ways to picture evolution by natural selection.

Conway Morris's Sustained Critique of Gould

Again, perhaps the most sustained critique of Gould's contingency argument has come from Simon Conway Morris. Conway Morris notes the pervasiveness of convergence in biology has implications for how we humans view the course of natural history and even our own existence: are we just a happy accident or is complex, sentient life biologically inevitable? Conway Morris argues that convergent evolution points to the latter. He has compiled manifold amounts of examples of convergence in nature and has employed them to argue that despite the apparent contingency, evolution is far more predictable than admitted by Gould (Conway Morris 1998; Conway Morris 2003; Conway Morris 2009, 1313–37; Conway Morris 2015). The idea is that physico-chemical natural laws impose certain constraints to what is possible, a sort of fine-tuning for biology. He writes, however, that "the likelihood of exactly the same cognitive

creatures—with five fingers on each hand, a vermiform appendix, thirty-two teeth, and so on evolving again if, somehow, the Cambrian explosion could be rerun is remote in the extreme" (Conway Morris 2003, xii). But what about the emergence of more general features in the evolutionary epic? Moreover, does the pervasiveness of convergence in biology have implications for how we view the course of natural history and even our own existence: i.e., are we just a happy accident or is complex, sentient biological life inevitable?

Conway Morris, as he started his revisions to Gould's thesis, was concerned precisely by the lack of predictability in biology, particularly in evolutionary biology—i.e., the assumptions that contingency reigns supreme and the outcome of the ages is left to random events. Conway Morris himself had a similar view during his early career in the late-1970s and early-1980s, digging out a bizarre series of fantastic-looking early animals from the famous Cambrian fossils of the Burgess Shale in Canada. Most of those fossils, at the time, were interpreted as precursors of branches in the tree of life that were dead-ends or were cut short in the early history of animals. Had an accident eliminated one of these early ancestors of the branch that led to us, indeed we humans would not be here. Famously, it was none other than Gould who, in his well-known *Wonderful Life* (1989c), arrived at the conclusion that history was dominated by *contingency*. Gould, of course, proposed that if we were "to rewind the tape of life" and replay it, intelligent, self-conscious, sentient beings would not be found in this imaginary alternative world. Not so fast, Mr. Gould, Conway Morris proverbially exclaims.

Conway Morris and Convergence

As more work on Cambrian fossils from other deposits was conducted (e.g., in China, Greenland), the proto-evidence challenged the view that many of these early oddball animals belonged to *phyla* unrelated to anything that evolved later. In some cases, it was found that they

were related to animals still around us (late-)modern humans. The idea is that physico-chemical natural laws impose certain constraints to what is possible. And, at this point, "predictability" in the evolutionary process and outcome enters the scene of the evolutionary play. Indeed, the phenomena known as convergence, which this section and the next explicate with reference to dagger-like canines in animals and several examples of the multiple convergences in camera-like and compound eyes in animals, indicates that evolution through natural selection may proceed along various paths, but the destinations are few. Constraint in evolution is central in determining what might never be possible as against the very likely, perhaps even inevitable. In fact, Conway Morris contends that when one looks at either the functionality of biological solutions or the roads taken in evolution, the choices are indeed restricted, if not inevitable (Conway Morris 2015, 31). A few overarching themes emerge from the literature on convergence. The most obvious is that convergent features arise in response to similar processing demands. Convergence operates at all levels of biological organization. However, convergence is never precise. Conway Morris writes,

> To paraphrase much of this book, life may be a universal principle, but we can still be alone. In other words, once you are on the path it is pretty straightforward, but finding a suitable planet and maybe getting the right recipe for life's origination could be exceedingly difficult: inevitable humans in a lonely Universe. Now, if this happens to be the case, that in turn might be telling us something very interesting indeed. Either we are a cosmic accident, without either meaning or purpose, or alternatively… (Conway Morris 2003, xiii).

The central theme of *Life's Solution* depends upon the realities of evolutionary convergence: the recurrent tendency of biological organization to arrive at the same "solution" to

a particular "need." Within it, there are four conclusions: First, what we regard as complex is usually inherent in simpler systems: the real unanswered question in evolution is not novelty *per se*, but how things are put together. Second, the number of evolutionary end-points is limited, meaning that in no way is everything possible. Third, what is possible has usually been arrived at multiple times. Finally, all this takes billions of years to become increasingly inevitable (Conway Morris 2003, xii-xiii). Convergence tells us at least two things: that evolutionary trends are real, and that adaptation is not some occasional component in the organic machine, but is central to the explanation of the derivation of life. It is therefore surprising, in light of the high probability for novelty, to find—even in similar niches—high morphological similarity in distinctly different genetic lines. Evolution is indeed constrained, if not bound. Despite the immensity of biological hyperspace, Conway Morris argues that nearly all of it must remain forever empty, not because our chance drunken walk failed to wander into it, but because the possibilities were from the beginning unavailable. This implies that it matters little what our starting point may have been, as the different routes will not prevent a convergence to similar ends, and that we may be on the verge of glimpsing a deeper structure to life.

Specific Examples of Convergence

Conway Morris gives an example from the world of predator-prey relationships: the dagger-like canines, in both placental cats (the saber-toothed cats) and a group of South American marsupials known as the thylacosmilids, independently evolved (see, e.g., Turnbull 1978). Conway Morris is quick to point out, however, that the identity between the thylacosmilids and saber-toothed cats is not exact (Conway Morris 2015, 54). In fact, the evidence suggests that even within the placental cats, the saber-toothed habit evolved at least three times: (1) in the primitive nimravids; (2) in the barbourofelids; and (3) in the machairodont

felids (see Turner and Antón 1977). Although as a group the marsupials are best known as kangaroo and wombat species, they tend to be regarded in some generalized sense as inferior to the placentals (Kirsch 1977, 276–88). Interestingly, John Kirsch suggests that the marsupium, that is, the pouch in which the young develop, actually arose several times independently within the marsupials. This, then, is an argument that presupposes that primitively this group of mammals lacked the pouch. So how does this factor into the presumed "progression" of biological life?

So, too, the rich, but now largely extinct, diversity of South American marsupials is widely regarded as having been competitively inferior to the placental mammals that surged south when the Panamanian isthmus was formed several million years ago (see Lessa and Fariña 1996, 651–62). In contradistinction to the prevailing notion, the saber shows a number of design advantages when compared with the placental equivalents in the marsupial thylacosmilids, including the possession of a protective flange, a self-sharpening mechanism, and a deeper insertion into the skull that presumably afforded a more secure housing for the canine. Despite this manifest convergence, neither group escapes its hallmark of phylogenetic history, which is marked in the specific structure of the teeth (see Koenigswald and Goin 2000). No entity, apparently, can escape its history.

Not only are the dagger-like canines convergent, but also are other features in entities within nature. For example, domesticated cats see through the dilated pupils of its camera eyes, whereas the mosquito sees through its compound eyes. Not only have both these types of eyes—camera and compound—evolved several times, but even the neural architecture underlying the sight mechanism has shown multiple convergences. The existence of camera and compound eyes reminds us that solutions to biological evolution need not be unique, but are simply very strongly

constrained. When considering convergences between camera-eyes, it is almost inevitable that comparisons will be drawn between the camera-eyes of vertebrates and those of the advanced cephalopods, notably the squid and octopus. Of course, there are well-known differences betwixt these two animals; most notable are those between the relative position of the light-sensitive layer, the retina, which arise as a result of the different embryologies in vertebrates and mollusks. In mollusks, the retina is derived from the ectoderm (the outer layer); as it involutes to make the eyecup, the associated nerve cells extend into the body to make their connection with the brain. The vertebrate retina, in contrast, is effectively an outgrowth of the central nervous system. The net result of this process is that in the vertebrates the nerve cells overlie the retina. The exit point of these nerves to the optic tract, which then leads to the brain, results in a "blind spot" in the retina. The arrangement of nerve cells and retina in mollusks and vertebrates is reversed, with the cephalopods having arguably the better design of nervous layer beneath sensory retina. So then, the earlier cephalopods have the better arrangement than the latter vertebrates—which has definite application to the (pre-?)assumption of "progress," does it not?

These differences are important, but it is still the case that the similarities between the human eye and those of a cephalopod are very striking. What is less well known is that a similar camera-eye has evolved independently in several other groups; for instance, the most notable is in a group of marine annelids (alciopids), which are close relatives of the more familiar earthworms (Conway Morris 2003, 152). These eyes are strikingly similar to those of the vertebrates and cephalopods, and because the annelids are also relatively closely related to the mollusks, the retina has the same arrangement as in the latter group, that is, without the "blindspot." There is, moreover, another convergence in the alciopid eye—the so-called accessory retinas, which are light sensitive patches located nearer to the front of the eye; these

are convergent on similar structures found in some deep-sea fish and cephalopods. Returning to the mollusks, considering this time the gastropods (snails), we find that in this group a camera-like eye seems to have evolved independently at least three times. Wald and Rayport (1977, 1439) remark, “The presence of accessory retinas in alciopid eyes offers a prime instance of the phenomenon of evolutionary convergence.” They suggest that these accessory retinas could be used to judge depth.

Nor does the list of convergently evolved camera-eyes quite end there; there are two more examples that Conway Morris recounts, each in their own way surprising. The first example comes from the primitive cubozoans, which are a type of jellyfish renown both for their highly toxic stings and for their remarkable eyes. The eyes are similar in construction to other camera-eyes, with a large lens located in front of the retina (Pearse and Pearse 1978, 458). Cubozoan jellyfish belong to a primitive group of animals, the cnidarians, which also includes the sea anemones and corals. While primitive eyespots are known in other cnidarians, at first sight the sophistication of the cubozoan eyes, which typically total eight arranged around the margin of the swimming bell (see the work by Blumer et al. 1995), is quite surprising, or even alarming (to me, anyway). What is particularly interesting is the relative simplicity of their nervous system, which consists of a nerve net linked to a series of four pacemakers, a neural architecture that is effectively imposed by the jellyfish body plan. There is no brain. Yet there are complex eyes and sophisticated behavior. So then, even considering rudimentary forms of life, the pattern of convergence dominates, suggesting that there is a God of purpose behind it all, wooing, if you will, the natural world forward in complexity. Or does it?

Critiques of Conway Morris

The Lack of Distinction(s) Betwixt Convergence and Parallelism

Gould mentions in passing broad scale examples of parallelisms as the discovery of substantial parallelism in the supposedly classical expression of the opposite phenomenon of convergence—that is, the development of eyes in arthropods, vertebrates, and cephalopods. The overt adult phenotype of these species, of course, remains largely convergent, but homology of the underlying regulators demonstrates the strong internal channeling of parallelism. For example, the vertebrate and squid version of the Pax-6 gene can both cause the development of eyes in Drosophila and produce ectopic expression of eyes in such odd places as limbs, which I myself have confirmed in the previous recounting of my experience with upland cotton species at Emergent Genetics, Inc. Gould also discusses smaller-scale examples of "convergence," reinterpreted as parallelism, because he contends that even more precise similarities exist among separate lineages within coherent clades—particularly the independent conversion of thoracic limbs to maxillipeds, by identical homeotic changes in the same Hox genes, in several groups of crustaceans. In fact, when the subject of internal constraint faded to a periphery of interest (or even of active denial) within the functionalist orthodoxy of selection's overarching power and adaptation's empirical preeminence at the height of the Modern Synthesis, the conceptual distinction of parallelism as a manifestation of internal channeling became uninteresting to most evolutionists (or, in the worst effects of biasing by restrictive theories, even unperceivable). With the defining feature of parallelism thus banished to a limbo of theoretical irrelevance, biologists limited their concern to the support provided for adaptationist preferences by the common feature of all homoplasies: the guiding power of independent selective regimes, whether aided by homologous internal channels (parallelism) or not (convergence), to fashion the same functional

result in separate lineages.

David B. Wake (1991, 543-44) writes,

> My central theme is the phenomenon of nondivergent evolutionary change among lineages, including convergent morphological evolution, parallelism, and some kinds of reversal—in other words, what phylogeneticists term homoplasy… Convergence and parallelism often are considered to constitute strong evidence of the functioning of natural selection. Patterson stated, "The general explanation for convergence is functional adaptation to similar environments" (Patterson 1988, 616–17), but I argue that alternatives must always be considered. In recent years increasing attention has been given to the possibility that parallelism is a manifestation of internal design constraints, and so both functionalist and structuralist constructs predict its occurrence.

As Wake's statement implies, two reasons—one "good" and the other "bad" in conventional, if simplistic, terms—underlie this movement of parallelism to a periphery of limited interest, or to conflation with convergence, which is actually a phenomenon of opposite theoretical import in judging the differential weights of constraint and adaptation in the origin of homoplasic similarities. According to Gould, Wake correctly identifies the "bad" reason, as an overemphasis on functionalist themes that limited the scope of evolutionary theory during the mid-century's height of enthusiasm for a "hardened" version of the Modern Synthesis (Gould 2002, 1080). Phenomena like parallelism, defined by components of internal constraint, did not elicit the attention of many evolutionists during this period. But, as Wake recognizes in the last sentence of his statement above, parallelism also received limited attention for the eminently "good" reason that, however well defined in a conceptual sense, the crucial distinction between parallelism and convergence could not be cashed-out in operational terms until rather recently.

This is simply because biologists could not identify the “homologies of underlying generators” (i.e., the shared genetic and developmental bases of independently evolved structures) needed to distinguish parallelism from the purely adaptational phenomenon of convergence (see Gould 2002, 1081).

The interesting literature on parallelism never lost this theoretical context throughout a century of research and commentary. The delay in resolution, and the prolongation of theoretical discussion, did not reflect any lack of clarity on the part of evolutionists, who largely understood and promoted the concept of parallelism and its potentially radical implications for Darwinian theory (Gould 2002, 1081). Rather, the persisting frustration about parallelism primarily recorded the inability of geneticists and developmental biologists to identify the generators posited as the basis of latent or underlying homology in the evolution of homoplasic structures deemed parallel rather than convergent. This stymied practice has now been opened, and we biologists have crossed a threshold into a period of amazingly fruitful research on parallelism in particular—and on the role of developmental constraint based on deep homology in general—for establishing the markedly nonrandom clumping of actual organisms within life’s potential morphospace. One understands why parallelism faded from general consideration when the strict adaptationism of hardened versions of the Modern Synthesis pushed the general subject of internal constraint to a periphery of intellectual concern and presumed irrelevance in the mid-twentieth century. Similarly, one should comprehend why the same phenomenon—and the importance of distinguishing its component of constraint from the purely adaptational basis of convergence—would have generated more interest and greater clarity of definition during the period of the 1890s to 1920s, when non-Darwinian formalist, and more overtly anti-Darwinian

orthogenetic and saltational, theories enjoyed considerable currency as adjuncts or alternatives to natural selection.

Parallelism has persistently been understood and debated as a theory of constraint based on homologous generators for the origin of homoplasic similarities. Two reasons exist for this ever-present recognition: first, the American paleontologists who initially codified the concept of parallelism did so in the context of pluralistic support for non-Darwinian internal mechanisms of evolutionary change (working in conjunction with, or potentially in opposition to, natural selection, which they also accepted as a valid mechanism). Parallelism is interesting in the contemporary environ as an indicator of preferred internal channels that selection can exploit in coordinated evolutionary change (Gould 2002, 1084). Second, continental European theorists in the formalist tradition emphasized constraint channeled by laws of form as a primary alternative to functionalist theories like natural selection; these scientists should therefore have taken a particular interest in parallelism, especially in its distinction from convergence for the origin of homoplasic similarity. This is because, simply, convergence exalts natural selection, while parallelism stresses internal channeling and supports the standard continental view of selection as a mere potentiator—or at most a minor diverter—of predictable and law like changes that must follow internally specified rules of morphogenetic transformation (Gould 2002, 1085). The distinction of parallelism and convergence may, ultimately, rest upon the predominant causality of constraint vs. adaptation (see Haas and Simpson 1946).

The older versions of evolutionary theory, prior to the Modern Synthesis, interpreted constraint as contrary to selection, thus earning the indifference or enmity of Darwinian theorists when they regained ascendancy during the 1930s and afterwards. This unfortunate historical situation troubled the utility of constraint within Darwinian theory as an adjunct, a potentiator, or

(at most distinction) an orthogonal source of evolutionary change. (Late-)modern versions of constraint (can) overcome this unfortunate division and reunite these two vital sources—formalist and functionalist—into an expanded and more general theory of Darwinian evolution. But the most perceptive of Darwinian theorists would not let such a contingent historical happenstance extinguish an important concept and distinction within the scope of evolutionary causality. Indeed, George Gaylord Simpson—a most brilliant and biologically sophisticated twentieth-century evolutionary paleontologist—continually emphasized the significance of a causal concept of parallelism based upon constraint, and the importance of distinguishing this mode of homoplasy from the (somewhat) opposite style of convergence based entirely upon shared adaptive contexts rather than shared homologous generators. Was he on to something, or was it all just “gaseous noise”?

George Gaylord Simpson’s Critiques from the Grave

In G. G. Simpson’s 1945 C.E. long article (dare I say treatise) on principles of taxonomy and classification of mammals, he formulates a dichotomous distinction between homology and convergence: “Animals may resemble one another because they have inherited like characters, homology, or because they have independently acquired like characters, convergence” (1945, 9). Simpson then writes of parallelism as “a third sort of process [that] also produces similarities”—for he recognized the “hybrid” nature of a concept that required independent episodes of similar selection, but nonetheless constructed homoplasic likenesses from homologous generators in two separate lines of morphospace. With his insight into these distinctions, Simpson made a discernible theoretical separation betwixt parallelism and convergence, but then was stymied. This was because the biology of his day knew no methods for identifying the homologous

generators that could mark a homoplasic similarity as parallel rather than convergent. Unable to cash-out his theoretical clarity in actual practice, Simpson admitted operational defeat:

> It is a complication that a third sort of process also produces similarities: parallelism. The term is descriptive rather than explanatory and refers to the fact that distinct groups of common origin frequently evolve in much the same direction after the discontinuity between them has arisen, so that at a later stage the phyla may have characters in common that were not visible in the common ancestry but that tend, nevertheless, to be more or less in proportion to the nearness of that ancestry. This proportional tendency distinguishes parallelism from convergence, but the distinction is far from absolute. The two phenomena intergrade continuously and are often indistinguishable in practice. (Simpson 1945, 9)

Simpson also stressed the intermediate nature of parallelism in inference of phylogeny, recognizing that even homoplasic characters usually record reasonably close genealogical affinity (in their common origin from homologous generators) in cases of parallelism, but must be regarded as confounders of affinity in cases of convergence:

> Homology is always valid evidence of affinity. Parallelism is less direct and reliable, but it is also valid evidence within somewhat broader limits. It may lead to overestimates of degree of affinity, but it is not likely to induce belief in wholly false affinity. Convergence, however, may be wholly misleading, and a principal problem of morphological classification on a phylogenetic basis is the selection of characters that are homologous or parallel and not convergent. (Simpson 1945, 10)

In his 1961 C.E. book on *Principles of Animal Taxonomy*, Simpson continued to express his frustration at the conceptual need—but operational impossibility—of distinguishing parallelism

from convergence: “The distinction of parallelism from convergence is vital,” he writes (1961, 106). Fifteen years after his joint paper with Haas, and their disagreement over the terms, Simpson simply stated in frustration:

> Parallelism is the independent occurrence of similar changes in groups from a common ancestry and because they had a common ancestry. Some students [e.g., Haas in Haas and Simpson, 1946] have preferred a more purely descriptive definition, especially by the geometrical model of parallel lines, symbolizing two lineages both changing but not becoming significantly either more or less similar… Most taxonomists do, however, consider that the term parallelism should be used only when community of ancestry is pertinent to the phenomenon. (1961, 103)

Simpson concludes his discussion with a clear statement for citing homology of underlying generators as the basis of parallelism, and on the joint operation of both overt selection and underlying homology in the evolution of homoplasic structures by parallelism: Parallelism has several theoretical bases that help one to understand and also to recognize it. The structure of an ancestral group inevitably restricts the lines of possible evolutionary change. That simple fact greatly increases the probability that among the number of descendant lineages several or all will follow one line. That probability will be further reinforced by natural selection in a geographically expanding and actively speciating group if the ecologies of diverse lineages remain similar in respect to the adaptations involved in the parallelism. The degree of dependence on similar ecology resembles that of convergence, but the retention of homologous characters from the relatively near common ancestry usually distinguishes parallelism. The parallel lineages (unlike those only convergent) furthermore start out with closely similar

coadapted genetic systems, and similar changes are more likely to keep the system adequately coadapted (Simpson 1961, 106).

Many biologists ignored the important theoretical differences between these two subcategories of homoplasy: i.e., parallelism and convergence. If they recognized parallelism and convergence as distinctive terms at all, they often could not state any rationale for the terminology beyond the triviality of an abstract and formal geometric difference between parallel and converging lines. However, thoughtful evolutionists continued to struggle with the "hybrid" character of parallelism. Charles D. Michener, for example, in the perhaps finest technical application of the concept, honored the causal (rather than geometric) distinction: "The potentiality for similar changes, resulting in parallel characters, no doubt results from the fact that related animals have homologous chromosomes and genes" (Michener 1949, 129–41).

Furthermore, there is a problem in the logic of Conway Morris's argument. Indeed, the degree of human intelligence and sentience are an evolutionary one-off accomplishment, apparently, though some groups—like dolphins and crows—do show abilities to solve problems and communicate in a fairly complex way. The problem is that complex human intelligence—and certainly religious belief and practice—is not convergent on *anything*. I have never understood how documenting evolutionary convergences says anything about the inevitability of a feature that arose only once, and this is a (the?) fatal flaw in all of Conway Morris's convergence work. Curiously, to me anyway, Conway Morris himself demolished the most effective case for the power of convergence—that is, Sidnie Manton's theory of the polyphyletic origin of the different phyla in arthropodal species, thereby thrashing (and trashing) the idea of no arthropodic "Eve" that would have better fit with Conway Morris's contentions regarding convergence. In fact, the possibility of a polyphyletic origin for the arthropods goes back to

Walcott's time and may have influenced Walcott's original interpretations of the Burgess Shale fauna. But this disproval of the nonexistence of arthropodic "Eve" postulation has now been demonstrated, convincingly so, and with it also the best example of the power of convergence to *pre*determine the outcome of the evolutionary epic. Instead, Conway Morris offers us the parallels between the marsupials and the placental mammals, his best example being the independent evolution of a marsupial that is very much like the saber-toothed tiger.

The main problem with this argument (and it is not a new one) is, in my opinion, the kangaroo of Australia. If convergence is in fact so "powerful," how was it possible for the kangaroos to proliferate into a singularly large component of the Australian fauna? That is, whereas nothing like the kangaroo (ever) developed (and more-so, never became dominant) among the placentals of the rest of the world? Gould's own interpretation of the Cambrian explosion through the lens of the Burgess Shale may have been pruned down from his original contentions, but I—as a biologist myself, and at least a part-time philosopher of biology—remain *un*convinced by Conway Morris's argument that the outcome of evolution is predictable, if not totally predetermined. After all, if placental kangaroos had taken charge outside the recluse realm of Australia, the natural world would look very different from the one we actually inhabit. Would it not? Perhaps, then, there are other issues at work, influencing Conway Morris's science?

Conway Morris's Religious Influence(r)?

It is evident, at least to me, that Conway Morris' religious outlook has influenced his "reading" of the paleontological data. Indeed, it seems that Conway Morris has allowed his (very public) spirituality to influence his science. At the very least, there appears to be the hint of a mixed message in Conway Morris' writings on convergent evolution (2003). When Conway

Morris says that "something like ourselves is an evolutionary inevitability," he may well mean it literally (that some form of intelligent being, but not Homo sapiens *sapiens*, is likely to have evolved). At the same time, many of his readers will interpret this quote (reinforced by the book's title: *Life's Solution: Inevitable Humans in a Lonely Universe*) as science providing support for the idea that humans (i.e., Homo sapiens *sapiens*; the species made *imago dei* according to the biblical witness) are an (the?) inevitable product of evolution. Of course, Conway Morris's earlier title, *The Crucible of Creation* (1998), only reinforces this possible interpretation. There is thus far more at stake in this debate than merely the nature of the Cambrian explosion, as especially witnessed to by the Burgess Shale fauna. Conway Morris is quite clear about how far he wants to extend the power of convergence: i.e., it guarantees the emergence of high intelligence (e.g., in mollusks like the octopus and in vertebrates) and of human spiritual faculties (in the Neandertals, e.g., as well as our own more direct ancestors). In the final analysis, Conway Morris wants us to believe that something very much alike unto modern human nature was "bound" to emerge (sooner or later) from (macro-)evolutionary processes. Of course, this contrasts starkly with Gould's position, who in effect follows a materialist tradition pioneered by the founder of contemporary Darwinian paleontology: i.e., the afore-mentioned G. G. Simpson, who insisted that humans were a most *un*likely product of a haphazard process.

Gould's Marxist leanings are well-known, and one can decipher thereby why Gould would favor a viewpoint that leaves the human race to figure out its *own* moral values with no hints provided by any transcendental source—this is what to expect from a generally-Marxist viewpoint. However, Conway Morris's opposition to this viewpoint of Gould's is driven by a more traditional (read: "Judeo-Christian") view of the human person. Conway Morris states that

our intelligence is a "gift," that we shall be "called into account" of how we used these "gifts," and that the evils perpetrated by humanity make sense *only* if they can be redeemed. For Conway Morris, Homo sapiens *sapiens* are not only the "intended" outcome of evolution—i.e., we may also be the *unique* embodiments of spiritual faculties in the universe. Conway Morris's last chapter in *The Crucible of Creation* (1998) is a brief but clear-cut rejection of the quasi-popular assumption that there are many life-bearing planets throughout our galaxy, if not beyond our own galaxy. For Conway Morris, evolution (again, I draw attention to the literal meaning of *evolutio*: that is, "unfolding") is predetermined, but it has only happened once—specifically, on this third rock from the sun. However, might not this convergent universe implicate purpose of some sort, when theologically approached? Might not this convergence thesis also implicate "humans" as being *imago dei*? I do not think either is the case, necessarily. After all, working with a Peircean view of *telos*, which will be elaborated upon in the next chapter, anything can—virtually—fill the "niche" of God's purpose. Anything, that is, that is maximally sentient. Pointedly, theism—broadly understood—does not necessarily need to be hooked to any particular scientific theory or philosophical construct, and it is better this way. This assertion, unfortunately, has been of no avail. Great is the power of steady misrepresentation (I am coopting these last two lines from Darwin's *Autobiography*, 1872).

Given their many profound differences in interpreting evidence, the great irony is that both Darwin and Conway Morris are in the same selectionist/adaptionist camp. That is, both tend to place too much emphasis on natural selection and adaptation, with insufficient emphasis on the non-adaptive mechanisms that Gould recognizes as contributing to evolution. It's unfortunate that the Darwinian tradition's (esp. August Weismann) selectionist/adaptionist interpretation of the evidence provides an incomplete and misleading account of Darwin's explanation of how

evolution has occurred. It is also regrettable that Conway Morris' selectionist/adaptionist interpretation of the evidence provides false hope to theologians and others who wish to see science reinforcing the religious understanding of reality. To recapitulate the importance of this chapter's line of argumentation for my overall project, please note the following: first, Conway Morris, whether it be either intentionally or unintentionally, actually reinforces the dominance of Darwinian adaptation in and through his writings. Second, while I do not agree with the Neoplatonic overlay by him upon his "discoveries," I nonetheless can build upon Conway Morris's implicit elevation of natural selection to its (rightful?) place of dominance. In this sense, then, Conway Morris chastens Gould's hypothesizing about contingency in (macro-)evolution, along with all that contingency hypothesis directly entails. As stipulated at the onset of this dissertation, I seek to work toward a quasi-synthesis of these two figures in evolutionary biology and paleontology. In so doing, I take from Conway Morris that while no entity can escape its history insomuch as all present-day entities must work with what they have been proverbially given from their contingent ancestors—through both the constraints of natural systems and the mechanisms of homoplasy itself (which includes e.g., homologous features, convergent features, and parallelistic features)—the paths toward the derivation of intensifications of sentience are markedly varied, but the destinations are few.

Having presented Conway Morris' "counterbalance" to the contingentist position of Gould, I will now make a philosophical excursion into a select contribution(s) of Charles Sanders Peirce, especially with reference to a philosophical statement of what I term to be the contingentist doctrine in embryonic form. We will see, for example, that his (or at least what I term his doctrine to be) "evolutionary developmental teleology," is one in which the *telos* of evolution is seen to be, broadly, increased complexity. This a *telos* of which is ever growing and

incessantly indeterminate. However, it also one that grows increasingly determinate through the passage of time, with its concomitant increases in complexity.

Chapter 5: Charles Sanders Peirce, Evolutionary Teleology, and the Contingentist Doctrine Stated

An Introduction to Charles Sanders Peirce: In Conversation with a Philosophical Enigma—The *Chancy* God

Let me explain before we move into the "meat" of this chapter, what I expect Peirce to add to my overall project. I expect to be able to substantiate that in Darwinian evolution, chance and randomness cooperate with each other. Further, in Peirce's conception of agapistic evolutionary love, if a final cause is a general type, then it might be actualized in any number of different ways insomuch as in this view, no matter what chance variation—and thereafter contingent processes within (macro-)evolution—produces with regard to the most-maximally sentient species, God can work said species into his overall *telos*. So then, God's final causes are not future events, but general possibilities instead. Employing Peirce's category of *tychism*, I contend that chance is central to teleology, and thus teleology is creative, exhibiting an irreducible novelty. As I also expect to demonstrate in this chapter, the third type of evolution written about by Peirce in his "Evolutionary Love" essay (1893)— Agapism—affirms the presence of a form of love that plays a role in the development of species. As such, it is the operative principle of "evolutionary love," which incorporates the best aspects of Darwinian evolution. Indeed, agapistic evolution is inherently open to variations and deviations to the laws and agencies of laws, but—at the same time—this third type of evolution incorporates also a sense of necessity, which is reflective of the growing (or evolving) laws of nature. Agapism is a form of evolution, then, that incorporates chance and necessity, but is not reducible to either, or merely the sum of the two together. It is, rather, a synthesis of these aspects with *telos*.

Synopsis of Position

Charles Sanders Peirce, by virtue of his developmental teleology, brought a unique understanding of reality to philosophy. Peirce's evolutionary philosophy was not bounded by classical determinism, as he stressed its illogicality. His threefold description of evolution, comprised of tychism, anancasm and agapism, provides a plausible account of evolution that is in some sense explainable by reference to teleology. For Peirce, final causation without efficient causation is helpless, while efficient causation without final causation, however, is worse than helpless—it is mere chaos. Peirce compares the relationship between efficient and final causation to that between the sheriff and the court. Final causation cannot be imagined without efficient causation just as the court cannot be imagined without a sheriff. Peirce contends that spontaneity will not be overcome by some final end or *telos*. For Peirce, no final cause is actual, in the sense that it is not specific; instead, every final cause is a general type. Peirce's views upon evolutionary causation, moreover, actually complement his view of evolutionary developmental teleology, and could—in fact—be seen as an application of his thoughts upon the former issue. Peirce contends that final causes are basically habits: i.e., they direct processes toward an end state. The habits of nature (which we refer to as the laws of nature) are final causes because they display tendencies toward an end state. Moreover, according to Peirce, every event is characterized not only by an aspect of final causation and an aspect of efficient causation, but also by an aspect of objective chance. For Peirce, there are three cosmological principles: (1) tychism (or chance); (2) agapism (or love); and (3) synechism (or continuity). Succinctly, Peirce's teleology is more than a mere purposive pursuit of a predetermined end; it is an evolutionary developmental teleology. Thus, final causes evolve, and they are not static.

Brief Biography of Peirce

Charles Sanders Peirce was born on 10 September, 1839 C.E. in Cambridge, Massachusetts, and he died on 19 April, 1914 C.E. in Milford, Pennsylvania. Peirce graduated from Harvard in 1859 C.E. in general studies, and then received the bachelor of science degree in chemistry in 1863 C.E., graduating *summa cum laude*. Except for his remarkable marks in chemistry Peirce was a poor student, typically in the bottom third of his class. Apparently, the standard curriculum bored him, insomuch as he mostly avoided doing seriously its required work. Peirce was a prolific writer, with his writings extending from about 1857 C.E. until near his death, a period of approximately fifty-seven years. In the course of his polymathic researches, his published works amount to about 12,000 printed pages and his known unpublished manuscripts amount to about 80,000 handwritten pages. The topics on which he wrote have an immense range, from mathematics and the physical sciences at one extreme, to economics, psychology, and other social sciences at the other extreme.

For thirty-two years, from 1859 C.E. until the last day of 1891 C.E., Peirce was employed by the U. S. Coast and Geodetic Survey, mainly surveying and carrying out geodetic investigations. Though his experimental and theoretical work on gravity determinations had won international recognition for both him and the Survey, he was in frequent disagreement with its administrators from 1885 C.E. onward. He finally resigned from the Geodesic Survey unit as of the end of 1891 C.E., and, from then until his death in 1914 C.E., he had no regular employment or monetary income. For some years, however, he was a consulting chemical engineer, mathematician, and inventor.

Some of this work Peirce undertook simply to finance his diurnal existence (and that of his first wife Melusina [Zina] Fay), while he devoted the main force of his thinking to abstract logic. Nevertheless, the geodetic tasks involved making careful measurements of the intensity of

the earth's gravitational field by means of using swinging pendulums. The pendulums that Peirce used were often of his own design. For over thirty years, then, Peirce was involved in practical and theoretical problems associated with making very accurate scientific measurements. This practical involvement in physical science was crucial in his ultimately coming to reject scientific determinism.

Peirce's logic teaching job at Johns Hopkins was suddenly terminated in 1884 C.E. for reasons that were apparently connected with the fact that Peirce's second wife (Juliette Annette Froissy, otherwise known as Juliette Annette Pourtalai) was Romani, and moreover a woman with whom Peirce had more or less openly cohabited before marriage, as well as before his divorce from his first wife Zina. For the remainder of his life, except for money inherited from his mother and aunt, Peirce was often in dire financial straits; sometimes he managed to survive only because of the overt or covert charity of relatives or friends, for example that of his old friend William James. In 1887 C.E., Peirce spent part of his inheritance from his parents to buy 2,000 acres of rural land near Milford, Pennsylvania, which never yielded an economic return. There he had an 1854 C.E. farmhouse remodeled to his design. The Peirce's named the property "Arisbe," and there they lived with few interruptions for the remainder of their lives, with Charles writing prolifically, much of which is unpublished to this day. Living beyond their means soon led to grave financial and legal difficulties. He spent much of his last two decades unable to afford heat in winter and subsisting on old bread donated by the local baker. Unable to afford new stationery, he wrote on the backside side of old manuscripts.

Lecture series, such as those organized by William James, along with a knack for writing for dictionaries and popular magazines, were Peirce's main philosophical outlet and primary source of income after his dishonorable dismissal from the Geodesic Survey unit. Attempts to

secure money from the Carnegie Institution to fund a full statement of his philosophical system in 1902 C.E. failed and between the 1890s and his death from cancer in April 1914 C.E., Peirce lived in a state of abject poverty, struggling all the while to find an outlet for his work. Most of Peirce's published work petered out into a series of rejections and incomplete projects, and although he did not stop writing until his death, he failed to publish a mature account of his philosophy while alive. Peirce died lost and under-appreciated by all but a few of his American contemporaries. Peirce was the founder of American pragmatism (after about 1905 C.E., Peirce called this concept, "pragmaticism," in order to differentiate his views from those of William James, John Dewey, and others, which were then being labelled "pragmatism"). A theorist of logic, language, communication, and the general theory of signs (which Peirce often called "semeiotic"), Peirce was an extraordinarily prolific logician, and a developer of an evolutionary, psycho-physically monistic metaphysical system. Practicing geodesy and chemistry in order to earn a living, he nevertheless considered scientific philosophy, and especially logic, to be his true calling, that is, his real vocation.

An Introduction to Firstness, Secondness, and Thirdness

Charles Sanders Peirce was a novel thinker, in terms of both originality and in application. One area of his originality was his developmental teleology. Another area of originality is his novel conceptioning of evolutionary causation, which is founded upon his foundational and fundamental three categories of Firstness, Secondness, and Thirdness. In what follows, I will argue the notion of an "evolutionary developmental teleology" is applicable to Peirce's idea of teleology in general. Seen as such, final causes evolve, and they are not static. This contention means that teleology emerged out of the increasing complexification of life on earth, and continues to be general, not specific in its derivation.

Moreover, in Peirce's agapasm, as explicated in a later section of this chapter, God gives himself away in acts of amorepotent, uncontrolling love without any conditions as to the potential response(s) to that love bestowed, as well as to what response(s) may fulfill that amorepotent, uncontrolling love. Rather, it is merely a completely reckless and overflowing display. Seen as such, the many and varied manifestations of complexity that (macro-)evolution has given rise to are to be seen as a fulfillment of the teleological "intentions" of God. Theists of all stripes should find Peirce's thinking on teleology and causation to be amenable to their worldview, influenced as it is by a strong conception of the amorepotent love of God as I call it, particularly that which is uncontrolling (see Tom Oord). Indeed, my own posit of amorepotent love, as well as Oord's posit of God's uncontrolling love are potent in application to the presence of randomness and chance in the natural environment. I find that notion to be consonant with my view of a God who lures creation to higher levels of complexity through the processes of biological evolution on the basis of his amorepotent love, a contention which also should be welcomed by theists all over the world.

Peirce on Evolutionary Developmental Teleology

Charles Sanders Peirce's evolutionary philosophy was not bounded by classical determinism, as he stressed its illogicality. He notes, "We must therefore suppose an element of absolute chance, sporting, spontaneity, originality, freedom, in nature" (Peirce 1992, 243). In what follows, I explicate three models of evolution as presented by Peirce. His threefold description of evolution, comprised of tychism, anancasm and agapism, provides a plausible account of evolution that is in some sense explainable by reference to teleology, which is a major development for theology and science in the twenty-first century, at least I contend that is. Moreover, I explain how Peirce, by virtue of his developmental teleology, brought a unique

understanding of reality to philosophy. Furthermore, I dialogue with Peirce, drawing from him a developmental teleological view, which will then be applied to a modern rendition of teleology that may be palatable for the evolutionary sciences. An "evolutionary developmental teleology," as I refer to it, based upon the implicit arguments found within Peirce's seminal writings, is proposed, whereby the *telos* of evolution is seen to be, broadly, increased complexity—a *telos* of which is ever growing and incessantly indeterminate. However, first allow me a brief excursion into causality from the seventeenth-century onward (note this is not meant to be comprehensive).

According to Clatterbaugh, three major transitions occur during the years 1671–1739, of the modern causation debate regarding the nature of causation. First, the notion of causation is simplified. Second, the notion of causation is secularized. Third, the concern of the causation debate is changed from the metaphysical problem of causation to the attempt to identify true causal connections (Clatterbaugh 1999, 12). At the beginning of the debate regarding causation in the seventeenth century, there were four types of causes: material, efficient, formal, and final (Clatterbaugh 1999, 15). The discussion regarding causation culminates with David Hume, who reduces the Aristotelian four causes to efficient causation only; causation and determinism thereafter became virtually equivalent (for this assertion, see Wang 2005, 615; cf. McCall 2017a; McCall 2017b).

Final causation (teleology), though being constantly neglected and forgotten since the beginning of modernity, I contend, remains the hidden foundation of all causal explanations and thus of mechanism itself. In order for this hidden foundation to come to light, we need first have a closer look at the inherent unity of four kinds of causes and the constant conjunction of efficient causation and final causation (a more detailed and insightful discussion of the complementary relation between efficient and final cause can be found in Short 1981, 376–79;

and in Hulswit 1996, 188–91). Peirce interprets the interdependence of efficient and final causation in this way: "Final causation without efficient causation is helpless: mere calling for parts is what a Hotspur, or any man, may do; but they will not come without efficient causation. Efficient causation without final causation, however, is worse than helpless, by far; it is mere chaos; and chaos is not even so much as chaos, without final causation: it is blank nothing" (Peirce 1998, 124). At the same time, Peirce compares the relationship between efficient and final causation to that between the sheriff and the court. Final causation cannot be imagined without efficient causation just as "the court cannot be imagined without a sheriff." On the other hand, "an efficient cause, detached from a final cause in the form of law, would not even possess efficiency" (Peirce 1998, 121). In his "A Syllabus of Certain Topics of Logic" for his 1903 Lowell Lectures, Peirce fiercely criticized the neglect of final causation in the modern era, stating "the non-recognition of [final] causation, . . . has been and still is productive of more philosophical error and nonsense than any or than every other source of error and nonsense. If there is any goddess of nonsense, this must be her haunt" (Peirce 2021, 383).

Peirce on Chance and Final Causality

Peirce contends that spontaneity will not be overcome by some final end or *telos* (Hausman 1993, 17). As such, Peirce notes that the universe will always contain some irregularity in it—in essence there will always be an expression of both freshness and brute fact in the universe. Indeed, for Peirce, there must be some "absolute chance" in the universe and "at any time… an element of pure chance survives and will remain until the world becomes an absolutely perfect, rational and symmetrical system, in which mind is at last crystallized in the infinitely distant future" (Peirce 1932-36, 6:33). It is important to the point of this chapter that Peirce notes that this will occur in the infinitely remote future, not in the near future. For Peirce,

"no final cause is actual; every final cause is a general type" (Short 1981, 369). Like Aristotle, Peirce avers that final causes work with efficient causes (Peirce 1932-36, 1:220); he argues for more than that, however, as "final causes tend to create or find the efficient causes that are necessary for their realization" (Peirce 1932-36, 2:149). Entities, whether animate or not, attempt to "actualize in their own way the same general type or possibility actualized in the fullest possible way in God… a general type is a final cause because of the goodness that would characterize any actualization of it" (Short 1981, 371). In fact, in Darwinian evolution, "random variation & tautology cooperate to produce order… [and] if a final cause is a general type, then it might be actualized in any number of different ways" (Short 1981, 372). In this view, then, no matter what chance variation—and thereafter contingent processes within (macro-)evolution—produces, God can work it into his overall *telos*.

In agreement, working from a Peircean view, Menno Hulswit defines final causes as "general types that tend to realize themselves by determining processes of mechanical causation. Final causes are not future events, but general (physical) possibilities which may be realized in the future" (1996, 188). Employing Peirce's category of tychism, Hulswit notes that chance is central to teleology, and thus teleology is creative, exhibiting an irreducible novelty (1997, 746). This unpredictability and irreducibility "is the reason why final causes cannot specify exact results" (Hulswit, 1996, 195). It is for the same reasons that end states can be reached in different ways. By denying that final causes are static, unchangeable events, Peirce avoided the problems attached to classical essentialism, which beset the Aristotelian perspective on teleology in the Enlightenment—wrongly or rightly—and thereby provides a way to reintroduce final causation (teleology) in a scientifically respectable manner in today's environment (Hulswit 1997, 766).

Peirce on Evolutionary Causation

This section of the chapter transitions to focusing on Peirce's view upon evolutionary causation, how it complements his view of evolutionary developmental teleology, and could, in fact, be seen as an application of his thoughts upon the former issue. Peirce contends that bodies indeed obey the laws of mechanics, but it may be that if our means of measurement were better, or if we were able to wait inconceivable ages for an exception, deviations to any law may be found. The terms causation and causality are often used as synonyms. In *From Cause to Causation: A Peircean Perspective*, however, Hulswit makes a distinction between causation, or the *production* of an effect by its cause(s), and causality, which is defined as the *relationship* between cause and effect. Although Peirce never explicitly made this distinction, he implicitly did so by criticizing the principle of causality, and by elaborating a constructive theory of *causation*; in Peirce's conception, there is a triple *interdependence* of final causation, efficient causation and chance (Hulswit 2002, 44–45). Peirce states the problem succinctly: "The great principle of causation which, we are told, it is absolutely impossible not to believe, has been one proposition at one period in history and an entirely disparate one [at] another and is still a third one for the modern physicist. The only thing about it which has stood […] is the *name* of it" (Peirce 1993, 197).

This confusion is at least partly due to the complex evolution of the concept of cause. The modern concept of cause is the result of the interplay between the Aristotelian-Scholastic conception—according to which causes are *active* initiators of a change, and the modern scientific conception—according to which causes are the *inactive* nodes in a law-like implication chain. Although the Aristotelian-Scholastic conception of cause has remained an aspect of our common-sense idea of "cause," the modern scientific view is without question the most predominant in philosophical discourse. According to the latter view, causation means some sort

of *law-like* relation between cause and effect, rather than the *production* of an effect by its cause. Peirce's conception of causation, however, is different, according to which each act of causation involves a *teleological*, an *efficient* and a *chance* component. Peirce's conception of causation in fact holds a middle way between the Aristotelian-Scholastic conception of cause and the modern scientific conception of cause, and thus is to be lauded.

Peirce's Highly Original View of Causation

In his 1902 C.E. paper "On Science and Natural Classes," Peirce developed an original view of causation in that each act of it involves an efficient component, a final component, and a chance component (Peirce 1998, 115). The efficient aspect of causation is that each event is produced by a previous event (the efficient cause), whereas the teleological aspect is that each event is part of a chain of events with a definite tendency (the final cause). The chance component, moreover, is that each event has some aspect that is determined by neither the efficient nor by the final cause. Again, according to Peirce, final causes are general types that tend to realize themselves by determining processes of efficient causation. Final causes are basically habits: they direct processes toward an end state. The habits of nature (which we refer to as the laws of nature) are final causes because they display tendencies toward an end state. Moreover, these habits are not static entities because they may evolve in the course of time. Peirce called the possible evolution of final causes "developmental teleology" (Peirce 1992, 331). Thus, final causes are not future events, *per se*, in that they are not strictly defined beforehand, but are general possibilities instead, for the end state of the process to which the act of causation belongs can be reached in different ways. It is therefore a mistake to contend that a *telos* is referent to a future state of affairs influencing the present state of affairs. In fact, Peirce says this much in writing:

> We must understand by final causation that mode of bringing facts about according to which a general description of result is made to come about, quite irrespective of any compulsion for it to come about in this or that particular way; although the means may be adapted to the end. The general result may be brought about at one time in one way, and at another time in another way. Final causation does not determine in what particular way it is to be brought about, but only that the result shall have a certain general character (Peirce 1932-36, 1:211).

So then, the idea that *efficient causation* can only be understood within the context of final causation is central to Peirce's conception of causation. According to him, "efficient causation [...] is a compulsion determined by the particular condition of things, and is a compulsion acting to make that situation *begin* to change in a perfectly determinate way; and what the general character of the result may be in no way concerns the efficient causation" (Peirce 1932-36, 2:120). The efficient cause functions as a *means* for the attainment of the end. Thus, "final causality cannot be imagined without efficient causality" (Peirce 1932-36, 1:213).

Moreover, according to Peirce, every event is characterized not only by an aspect of final causation and an aspect of efficient causation, but also by an aspect of *objective chance*. Each natural process involves an aspect of objective chance at every stage of the process, which *cannot* be reduced to efficient or final causation. Above, I explained that Peirce's conception of causation is characterized by a triple *interdependence* of final causation, efficient causation, and chance. Keeping in mind that we earlier distinguished two mutually incompatible conceptions of cause—the Aristotelian-Scholastic conception and the modern scientific conception—I conclude that Peirce's conception of causation forms an ingenious middle way betwixt these two conceptions. On the one hand, Peircean causes are the *active initiators* of a change (rather than

the inactive nodes in a law-like implication chain). On the other hand, however, the action of a cause is essentially a case of the *operation of a law*, and in fact directly implies a law (or habit).

An Explication of Peirce's Three Categories

This section of the present chapter begins by highlighting the three original, yet fundamental categories as outlined by Peirce. Peirce's entire system of thought, it could be said, rests upon his notion of three fundamental categories, which he calls Firstness, Secondness, and Thirdness (Peirce 1998, 272–73). He derived these categories by two independent methods, one deductive and the other phenomenological. He summarizes the categories as follows:

> The First is that whose being is simply in itself, not referring to anything nor lying behind anything. The Second is that which is what it is by force of something to which it is second. The Third is that which is what it is owing to things between which it mediates and which it brings into relation to each other (Peirce 1992, 246).

Expanding on his category of Firstness, Peirce emphasized that because its nature is to be independent in origin from anything else, it can never be adequately grasped or described:

> The idea of the absolutely First must be entirely separated from all conception of or reference to anything else; for what involves a second is itself a second to that second. The First must therefore be present and immediate, so as not to be second to a representation. It must be fresh and new, for if old it is second to its former state. It must be initiative, original, spontaneous, and free; otherwise it is second to a determining cause. It is also something vivid and conscious; so only it avoids being the object of some sensation. It precedes all synthesis and all differentiation: it has no unity and no parts. It cannot be articulately thought: assert it, and it has already lost its characteristic of innocence; for assertion always implies a denial of something else. Stop to think of it, and

> it has flown! (Peirce 1998, 248).

So then, once we conceive of any phenomenon that manifests something of the nature of otherness, we meet the category of Secondness:

> The Second is precisely that which cannot be without the first. It meets us in such facts as Another, Relation, Compulsion, Effect, Dependence, Independence, Negation, Occurrence, Reality, Result. A thing cannot be other, negative, or independent, without a first to or of which it shall be other, negative, or independent… We find secondness in occurrence, because an occurrence is something whose existence consists in our knocking up against it… The idea of second must be reckoned an easy one to comprehend. That of first is so tender that you cannot touch it without spoiling it; but that of second is eminently hard and tangible. It is very familiar too; it is forced upon us daily: it is the main lesson of life (Peirce 1992, 248–49).

Finally, Thirdness is the category that introduces the possibility of mediation, which cannot arise from either Firstness or Secondness alone:

> First and Second, Agent and Patient, Yes and No, are categories which enable us roughly to describe the facts of experience, and they satisfy the mind for a very long time. But at last they are found inadequate, and the Third is the conception which is then called for. The Third is that which bridges over the chasm between absolute first and last, and brings them into relationship (Peirce 1992, 249).

Whereas the category of Firstness is characterized by an "airy-nothingness" and Secondness is characterized by the "Brute Actuality of things and facts," Thirdness "comprises everything whose being consists in active power to establish connections between different objects" (Peirce 1998, 435). In this view, Thirdness is the source of meaning and intelligibility in

the universe (Corrington 1993, 135). Peirce speculated that the order (Secondness) and intelligibility (Thirdness) of the universe evolved from a primordial condition of indeterminate chaos (Firstness):

> In the beginning,—infinitely remote,—there was a chaos of unpersonalised feeling, which being without connection or regularity would properly be without existence. This feeling, sporting here and there in pure arbitrariness, would have started the germ of a generalising tendency… Thus, the tendency to habit would be started; and from this with the other principles of evolution all the regularities of the universe would be evolved (Peirce 1992, 297).

Peirce's Three Cosmological Principles Explained

For Peirce, there are three cosmological principles: (1) tychism (or chance) (1932-36, 6:102); (2) agapism (or love) (6:287); and (3) synechism (or continuity) (6:173). Peirce's objective idealism involves a developmental teleology (a position between nominalism and realism), which is a view wherein final causes are not future certainties, but present possibilities that may be attained in the future. Hence there is no fixed end of the world; rather, all things are marked by continual growth and change, that is, they are evolving. Regarding his conception of evolution, Peirce writes: "Three modes of evolution have thus been brought before us: evolution by fortuitous variation, evolution by mechanical necessity, and evolution by creative love. We may term them tychastic evolution, or tychasm, anancastic evolution, or anancasm, and agapastic evolution, or agapism" (1932-36, 6:302). The first kind of evolutionary theory discussed is represented by the Darwinian view, which views evolution proceeding "heedlessly" by discontinuities (or chance variations) appearing with no reason whatsoever (1936, 6:287–97). Chance—for the tychistic-type of evolution—is not associated with any particular "direction."

Peirce writes, “Natural selection, as conceived by Darwin, is a mode of evolution in which the only positive agent of change in the whole passage from moner to man is fortuitous variation” (Peirce 1992, 358). Evolution by strict chance is a manifestation of Peirce’s category of Firstness, because Firstness is the category in which a lack of determination by other events or entities is the chief characteristic. Peirce, ultimately, found Darwin’s scheme—considered alone—unsatisfactory (Peirce 1992, 357).

The second type of evolution discussed within Peirce’s essay titled “Evolutionary Love,” is anacasticism, which Peirce characterizes as deterministic. He writes, “diametrically opposed to evolution by chance are those theories which attribute all progress to an inward necessary principle, or other form of necessity” (1932-36, 6:298). The necessity herein referred to is mechanical in nature. This anacasticism is deterministic; indeed, whether internal or external, the necessity works so that evolution proceeds through a succession of events from which they cannot deviate. Nothing is due to chance (Hausman 1993, 174). This second possible mode of evolution—“anancastic” evolution—is that which is constrained completely by necessity and determination by something other than itself. In contradistinction to this “anancastic” view, and in support of Peirce’s own position, many current positions regarding (macro-)evolutionary theory argue that the process of evolution reflects a balance of chance and necessity (see, e.g., Bartholomew 1984; see also Ward 1996). In Peircean terms, these (late-)modern theorists argue for a balance between Firstness and Secondness. However, Peirce rejected the idea that such a balance—by itself—offers an adequate explanation of the world as we know it, proffering instead that a complete explanation of evolution requires the category of Thirdness beyond the categories of chance (Firstness) and necessity (Secondness) (Peirce 1992, 331).

The third type of evolution written of in Peirce's "Evolutionary Love" essay affirms the presence of a form of love that plays a role in evolutionary development (Hausman 1993, 174). *Agape*—which Peirce calls the operative principle of "evolutionary love"—is inherently open to variations and deviations to the laws and agencies of laws. This third type of evolution—also known as agapism—incorporates the other two types of evolution described within "Evolutionary Love." Agapism is a form of evolution, then, that incorporates chance and necessity, but is not reducible to either, or merely the sum of the two together. It is, rather, a synthesis of these aspects with "something else," which I take as being a reference to, presumably, *telos*. For Peirce, an evolutionary developmental teleology prevails at all levels and all stages of evolution (Hausman 1993, 16).

Peirce (1992, 363) also regarded Thirdness as the category that gives to the universe "a vital freedom which is the breath of the spirit of love." Therefore, he referred to this third mode of evolution also as "agapastic" evolution, building upon the Greek term *agape*, which translates into English as "love." He commented, regarding this mode of evolution, that "everybody can see that the statement of St. John [i.e., "God is love," 1 John 4:8] is the formula of an evolutionary philosophy, which teaches that growth only comes from love… The philosophy we draw from John's gospel is that this is the way mind develops; and as for the cosmos, only so far as it yet is mind, and so has life, is it capable of further evolution" (Peirce 1992, 354). I contend, in dialogue with Peirce, that final causation without efficient causation is helpless, whereas efficient causation without final causation, is worse than helpless—it is mere chaos. Thus, with Peirce, I contend that spontaneity will not be overcome by some final end or *telos*. Entities, then, whether animate or not, imbued with agential power from God's *kenosis* of the Spirit into the natural world, thereafter attempt to actualize in their own way the same general type or

possibility that is actualized in the fullest possible way in God. A general type, then, is a final cause because God can work it into his intentions, regardless.

This means, then, that God did not set-out to "create" Homo sapiens *sapiens*, *per se*, but maximally sentient entities instead. So then, the particular maximally sentient species that ultimately resulted in fact from the evolutionary process—that is, us humans—were not, necessarily, God's intended result. In building on this view, then, I assert that whatever the actual species ended up to be, God would have descended into them through the *kenosis* of the Son regardless. Thus, this view, while in some sense making "humans" less important to God's overall *telos*, nonetheless heightens the importance of them as well. In fact, in Darwinian evolution, chance and randomness cooperate with each other, and if a final cause is a general type, then it might be actualized in any number of different ways. Indeed, in this view, then, no matter what chance variation—and thereafter contingent processes within (macro-)evolution—produces with regard to the most-maximally sentient species, God can work said species into his overall *telos*. So then, God's final causes are not future events, but general possibilities instead. Employing Peirce's category of tychism, I contend that chance is central to teleology, and thus teleology is creative, exhibiting an irreducible novelty. It is for the same reasons that end states can be reached in different ways.

As aforenoted, the third type of evolution written about by Peirce in his "Evolutionary Love" essay affirms the presence of a form of love that plays a role in development. *Agape*—the operative principle of "evolutionary love"—incorporates the best aspects of Darwinian evolution, as it is inherently open to variations and deviations to the laws and agencies of laws. But, this third type of evolution—also known as agapism—incorporates also a sense of necessity, which reflects the growing (or evolving) laws of nature. Agapism is a form of

evolution, then, that incorporates chance and necessity, but is not reducible to either, or merely the sum of the two together. It is, rather, a synthesis of these aspects with "something else," which I take to be a reference to *telos*. In the next chapter, we will dialogue with Thomas Jay Oord and others, in order to enflesh Peirce's conceptioning of agapism.

Chapter 6: Thomas Jay Oord's Theology of Uncontrolling Love Revised, Refined, and Expanded

An Introduction to Thomas Jay Oord—The *Uncontrolling* God

Love is something I can enjoy as a human only if it is self-giving in its orientation, and this condition applies to both God as well as humans. In this chapter, I will seek to build on the insights regarding love by both Vincent Brümmer and Thomas Jay Oord, with an assist by Karol Wojtyla. I seek to illustrate the notion that God's *kenotically*-donated love is a synergistic symbiosis enacted through the Spirit of creativity that achieves greater evolutionary results combined than either aspect of the symbiosis alone. I picture this Oord-, Brümmer-, and Wojtyla-influenced depiction of my own as love that is "*kenotically*-donated," which onsets an evolving fertility, most proximately which is a result of the panentheistic relationship of God and world. This panentheistic relationship was initially wrought by the *kenotical* donation of God's very self through the Spirit into chaotic matter eons ago, as I established in McCall, "Kenosis of the Spirit into Creation," from 2008 C.E. Further, this panentheistic relation is now continually sustained and upheld by the repetitive impartation of his very self—through imbibification of the Spirit—into the natural world (as highlighted in McCall 2020a, particularly in chapter 8, 129–39). In noting that the love of God is *kenotically*-donated, I intend to highlight that God not only gives us love itself, but also himself in the very act of love. Further, in characterizing love as self-giving, I intend to once again draw attention to the fact that God gives of himself (liberally) to his creation and creatures of the creation. He imparts part of himself to it and them, both, in a "kenotical" (i.e., a self-giving, a self-donated, or an "infilling") manner, as particularly highlighted in McCall 2019b. Indeed, I will argue in this chapter for a notion of love that is *kenotically*-donated, self-giving, creative, amorepotent (as per McCall, forthcoming-b, particularly chapter 3), and uncontrolling (Oord). In so doing, I will use several of my works, as

well several of Oord's texts as my launching point, and will aim at substantiating that *kenotically*-donated, self-giving, creative, and uncontrolling love is empowering of the "other" and allows for the interactivity of matter and the godhead, since it is principally pneumatologically (i.e., Spirit) derived and based upon an imbibification of matter with the Spirit of God, which onsets the panentheistic orientation between God and the world.

Synopsis of Position

In *The Uncontrolling Love of God*, Oord notes that the oscillation of divine causation does not mean that God chooses sometimes to be more influential and other times to remain relatively uninfluential; instead, God's nature as love prompts God to exert the most influence possible in any situation. Oord contends that randomness, accidents and chance (contingency) reliably describe the character of at least some events in life; in other words, contingency characterizes existence at least sometimes or to some extent. The spontaneity inherent in existence generates chance and contingency, which plays a part in producing splendor and wonder. In fact, chance and contingency operating within lawlike regularities make possible new and creative forms of life and ways of living in our world. As a Process thinker (he studied under the distinguished David Ray Griffin), Oord focuses upon interactive relationality and other Process philosophical themes such as the emphasis upon activity over substance, wholeness and totality over bifurcations, innovation and novelty over continuity, creativity over stasis, change over persistence, and the contention that process is the principal category of ontological description.

Brief Biography of Oord

Thomas Jay Oord was born on 10 November, 1965, and is a theologian, philosopher, and scholar of multidisciplinary studies. He is also a noted public speaker, giving lectures on God

and nature in universities, churches, organizations, and seminaries. Oord is also known for his contributions to research on love, open and relational theology, science and religion, and the implications of freedom and relationships for transformation. As a scholar, Oord has written or edited more than twenty-five books. Indeed, Oord has written numerous notably significant books, including *Open and Relational Theology: An Introduction to Life-Changing Ideas* (2021); *God Can't: How to Believe in God and Love After Tragedy, Abuse, and Other Evils* (2019); *The Uncontrolling Love of God: An Open and Relational Account of Providence* (2015); *Defining Love: A Philosophical, Scientific, and Theological Engagement (*2010); *The Nature of Love: A Theology* (2010); *The Many Facets of Love: Philosophical Perspectives* (2007); and *Science of Love: The Wisdom of Well-Being* (2004). He has also edited numerous notably potent titles, including: *Theologies of Creation: Creatio ex Nihilo and Its New Rivals* (2015); *Relational Theology: A Contemporary Introduction* (2012); *God in an Open Universe: Science, Metaphysics, and Open Theism* (2011); *Creation Made Free: Open Theology Engaging Science* (2009); *Divine Grace and Emerging Creation: Wesleyan Forays in Science and Theology of Creation* (2009); and, with Bryan P. Stone, *Thy Name and Thy Nature is Love* (2001).

Oord attended Claremont Graduate University in Claremont, CA, earning both an MA and PhD in religion in 1999 C.E. Formerly, he taught for sixteen-years as a tenured professor at Northwest Nazarene University in Nampa, Idaho. Oord unfortunately "ran into trouble," so to speak, with Northwest Nazarene University for some of his "forward-looking views" in 2014 C.E. As a result, an unprofitable legal battle ensued, with Oord finally reaching permanent severance in 2018 C.E. Oord hopes that his beloved denomination (the Nazarenes, i.e.) may — sometime in the future—grow to accommodate his own views, but this is not indicative to reality

at the present time. He therefore currently directs a doctoral program at Northwind Theological Seminary in relationship with the Center for Open and Relational Theology.

Vincent Brümmer and Thomas Jay Oord on Love

"In a not-so-funny way, we are all prisoners of love" (Wagoner 1997, 135).

Both Vincent Brümmer and Thomas Jay Oord are theological giants when it comes to the exposition of Christian love. Brümmer's thoroughly relational concept of love is an apt portrayal that I will appropriate in my depiction of love within this chapter as fully kenotic—that is, *kenotically*-donated (McCall 2019b) and self-giving (see Brümmer 1993, 3). By the newly minted terminology of "*kenotically*-donated," I am referring to the methodology by which the Spirit of God's self-giving, uncontrolling love imbibes creation (McCall 2019b). After all, in many ways, the utmost expression of love is the utmost gift of the self (McCall 2019b). Notably, Robert E. Wagoner, in his *The Meanings of Love*, arrives at the same point. Indeed, Wagoner also pictures preeminent love to be of the self-giving variety. In fact, he calls it "the epitome of love. . . [for] there is enormous power in selflessness" (Wagoner 1997, 137). Further, according to Wagner, however love is defined, it must be understood as a relation of some kind (Wagoner 1997, 14). In fact, "from the Christian point of view love is something held in trust, something given, something I can enjoy only if I do not attempt to possess it" (Wagoner 1997, 47). So then, I deduce from Wagoner's statement that love is something I can enjoy only if it is self-giving in its orientation, which backs up one of the main thrusts of this current chapter. This condition, I submit to my reader, both applies to God as well as humans.

Colin E. Gunton, in his *The Promise of Trinitarian Theology*, backs this assertion up well. He asserts that the human person is one who is created to find his or her being in relation, first with other creatures alike unto him or her, and then with the rest of creation. This means that

we are in the image of God when, like God—but in dependence on his giving of self—we find our reality in what we give to others in human community (Gunton 1997, 113–14). My essentially *kenotical* God (McCall 2020b), who has an eternal nature marked by other-centered and other-empowering love (see McCall 2019b; McCall 2020b, 276), is *fully* consistent with Thomas Jay Oord's (2015) portrayal of an uncontrolling God. This uncontrolling love, as the contingentist Oord likes to say, necessarily provides full freedom and agency to each species within the natural world. This is especially true with regard to human animals, with God working to empower and inspire creation toward well-being and wholeness (Oord 2015, 94), to which I add the furtherance complexity, relationality, and beauty in varied and multifarious forms, along with the extension of diversity and increases of multiplicity (McCall 2019b, 284). Notably, I have coined the term "contingentist" to directly refer to someone who highly emphasizes contingency in his or her philosophy of *bios* (life) (McCall 2022).

Regardless of our attitude about religion, there is something very compelling about this radical image of self-giving as the epitome of love (Wagoner 1997, 137). One can hardly argue with it, for there is enormous power in it. In what follows, I will seek to build on the insights regarding love by both Brümmer and Oord, with an assist by Karol Wojtyla. I seek to illustrate the notion that God's *kenotically*-donated love is a synergistic symbiosis enacted through the Spirit of creativity that achieves greater evolutionary results combined than either aspect of the symbiosis alone (see McCall 2019c). This assertion means, then, that God's *kenotically*-donated love is both productive of emergent entities and effectual for the derivation of greater complexity within those entities in the natural environ. This *kenotically*-donated love onsets an evolving fertility, which most proximately is a result of the panentheistic relationship of God and world (see McCall 2020a, particularly chapter 5). This panentheistic relationship was initially wrought,

I assert, by the *kenotical*-donation of God's very self through the Spirit *into* chaotic matter eons ago, and is now continually sustained and upheld by the repetitive impartation of his very self—through imbibification of the Spirit—into the natural world (McCall 2019b).

Notably, the term "imbibification" is similarly a word coined by me to refer to the process regarding the descent of the Spirit into matter, which causes the Spirit to be thereby embedded within nature, and thereafter be embodied within it as well (McCall 2022, particularly chapter 3; see also McCall 2017c). Thereafter, marked by the embeddedness of Spirit, which is the agent of contingency within evolution, the natural world progressed in a serpentine manner into the advancement toward greater complexity, of which *Homo sapiens sapiens* are the pinnacle (at present, anyway) (see McCall 2022, chapter 4). In fact, God's world is teeming with randomness. It is, I like to say, smothered in contingency. Indeed, it is both smothered and stuffed with it. As such, it is marked by contingentist entities, which are themselves marked by contingency. Things do not happen according to a divine plan (see McCall 2017c, 222). Rather, there is always some semblance of absolute chance in the world, and thus at any time, an element of pure chance survives (see McCall 2019a, 133–42). God intends for entities to cooperate with his *kenotically*-donated love (McCall 2019a, 142).

Kenotical Love as Self-Donation and Self-Giving

I did not originate the terminology of love as self-donation, which is a principle upon which my "*kenotically*-donated love" is based (Karol Wojtyla did in *Love and Responsibility* [1993, 77]). Neither did I originate the terminology of "full-orbed," uncontrolling love (Tom Oord did; see, e.g., the book by the same name—i.e., Thomas Jay Oord, *The Uncontrolling Love of God* [2015]). If one looks at Karol Wojtyla's *Love and Responsibility*, he or she can find several different ways that Wojtyla (1993, 82) applies Thomistic principles to the modern study

of love as self-donation, which is—according to his reasoned judgment—a defining characteristic of love in relation to the "other." According to him, authentic love must include both an objective and a subjective dimension. Wojtyla refers this multi-dimensionality of authentic love as the law of the lover.

This conceptioning of authentic, self-donating love by Wojtyla entails—in my reckoning—the Spirit to go outside herself (*ad extra*) to both find and produce a fuller existence in another entity, whereby the epic of evolution is empowered (see McCall 2017d, 31). It should be noted, also, that Wojtyla's self-donating love is a strong correlate to Tom Oord's characterization of uncontrolling love. Accordingly, I will employ both terms—or at least their application—in what I have come to refer to as "*kenotically*-donated love" (McCall 2019b). This depiction is based fundamentally upon the notion, as I described it first in 2008 C.E., that God's *kenosis* of the Spirit amounts to self-giving (lit. a "pouring out" of the Spirit, or an "infilling") with reckless abandonment. This means that *kenosis* is *not* a mere self-emptying (or self-abnegation). Tom Oord and I have both, as a result, been picturing *kenosis* as essentially self-giving (or, to use my terminology, a "pouring out" into the other, an "infilling," or even as a "self-donation" to the other) for several years now.

Indeed, in a peer-reviewed article from calendar year 2008 C.E., I note that the Greek verb κενόω, from which the term *kenosis* is derived, can mean either "to empty," or "to pour out," with an equivalent meaning of "self-giving" (McCall 2008). I then contended that God's *kenosis* of the Spirit, that is, her "pouring out" into the natural world, enables the derivation of life and love itself (McCall 2008). About a decade later, I picked up on Wojtyla's description of love as self-donation. I then argued that the biblical tradition and the theological tradition give good grounds for illustrating the Spirit as the active agent of God in the natural world. This role

of the Spirit as the active agent of God within the natural world, particularly pictures the Spirit as the *life-giver* and *animator* of all "creation" through *kenotical*, self-donating and self-giving love (McCall 2017d, 24). These latter two—self-donating and self-giving love—I now note, are manifestations of God's love *to* his creatures, *for* his creatures, and *through* his creatures. Brümmer, then, is entirely correct when he notes that when we speak of theology, it is "the fundamentally metaphorical nature of all human thought and experience" (Brümmer 1993, 13). In what follows, I shall use the terms self-donating love and self-giving love *to* and *for* the natural world as illustrative metaphors with which to picture God's dynamic presence within the world in our (late-)modern context through *kenotical* donation.

Charles Hartshorne is right when he opines, "Theologians have never taken really seriously the proposition that God is love" (Hartshorne 1934, 97). Historically speaking, people have always had a hard time with love. Dealing with it, that is. All the more so when speaking of divine love that we humans often cannot either empirically detect, or directly discern mentally. In recent years, Oord has written nearly a half-dozen books regarding God's love, its affects, as well as what it effects in the world. In fact, one could legitimately say that Tom Oord is the leading theologian of love in today's academic context. This is but one reason why I have chosen to use his extensive writings to help me flesh-out my own construal of *kenotically*-donated, self-giving, and amorepotent, uncontrolling love. Some of these terms are Tom's own words (e.g., "uncontrolling"), while some are my terms (e.g., "*kenotically*-donated" and "amorepotent"), and some of these words have been worked through, so to speak, with both Tom and I (i.e., "self-giving").

In noting that the love of God is *kenotically*-donated, I intend to highlight that God not only gives us love itself, but also *himself* in the very act of love (cf. McCall 2019b). Further, in

characterizing love as self-giving, I intend to once again draw attention to the fact that God gives of himself (liberally) to his creation and creatures of the creation. He imparts part of himself to it and them, as I have afore-written, both in a "*kenotical*" (i.e., a self-giving, a self-donated, or an "infilling") manner (McCall 2019b). Hence, I say God's love is *kenotically*-donated. Picking up Oord's illustration of love as being uncontrolling, I gather from him that he means God gives out of his fullness, but does not insist on controlling the response(s) of his derivation to his impartation of love. Hence, the designation of his love as "uncontrolling." So then, God does not insist on having control. In point of fact, due to his nature primarily being *kenotically*-donated, self-giving love, I assert that God *cannot* (totally) control other entities, be they animate or not, although he could—and does!—lure, woo, and beckon entities toward himself. Not simply "will not," but "cannot!"—that is the assertion everywhere made in one of Oord's latest books, *God Can't* (2019).

I will argue in this chapter for a notion of love that is *kenotically*-donated, self-giving, creative, and amorepotent, as I term it, as well as uncontrolling (Oord). In so doing, I will use my own work, as well as several of Oord's texts as my launching point, and will aim at substantiating that *kenotically*-donated, self-giving, and creative love as well as uncontrolling love is empowering of the "other" and allows for the interactivity of matter and the godhead. This is simply because it is principally pneumatologically (i.e., Spirit) derived and based upon an imbibification[1] of matter with the Spirit of God, which onsets a panentheistic orientation between God and the world (see McCall 2021d). There is a danger that such a position could be labeled pantheism. However, if one were to consciously stipulate at all times that God is in the

[1] I have coined the term "imbibification" to refer to the process by which some entity, something, or someone is imbibed by the Spirit of God.

world thoroughly—but at the same time also more than the world—he or she could avoid such a distorting moniker.

In effect, I will be enfleshing the statement of Stephen G. Post (2003, viii) that the energy of love should be studied intently by religion. This type of study may well be illustrated by Tom Oord's (2004) oft-employed terminology of a "love, science, and theology symbiosis." In this Oordian synthesis, issues of love are given paramount importance in all areas of our lives, not just what has been historically been seen to lie within its domain (i.e., interpersonal relationships). This idea of a synergistic symbiosis of Oord's, in combination with what I coined to be *kenotically*-donated love, is itself highly instructive because it invokes the terminology of close, long-term biological associations wherein both entities benefit from the relationship, which is known as *mutualism* (McCall 2022). Or, alternatively, it could refer to close, long-term biological associations wherein one of the entities benefit solely, but not to the detriment of the other entity, which is a relation known as *commensalism* (McCall 2020a). Although *parasitism* is theoretically possible in such biological relationships that I am herein envisioning, I choose not to either include it or elaborate upon it because I view love (McCall, forthcoming-a), in conjunction with Tom Oord, to be inherently self-giving, other-centered, and other-empowering, versus being self-centered to the exclusion of the other entity, which would be the meaning of parasitism in this context. In many ways, I posit that the commensalistic association just mentioned is an apt metaphor for our relationship with God, in part because I cannot conceive how an entity such as God would "benefit," *per se*, from our reciprocated love (which would exclude *mutualism*, note). However, this does not mean that God is an aloof monarch, unresponsive to our human experiences on earth. Rather, I am simply stating that the deity

cannot become “more perfect” from involvement with his entities. So, what’s love got to do with it?

Vincent Brümmer and The Model of Love More Pointedly Explicated

As Vincent Brümmer acknowledges, love is not merely an aspect of God’s relation to us humans and to the world in which we live in the Christian faith, but rather the very *key* to understanding what this relation is all about (Brümmer 1993, 3). Our relation to God is very complex, of course, involving as it does many other aspects. For instance, our relation to God in some manner and in some way, involves: (1) God’s power; (2) his authority; (3) his justice; (4) his wisdom; (5) his knowledge; (6) his goodness; (7) his steadfastness; and (8) his presence. However, God’s love is in some manner central to our understanding of his relation to us humans and thus, ostensibly, to the way we are to understand all these other aspects of the relation as well. Brümmer notes that with respect to systematic theology, this would suggest that “love” is a (the?) candidate for the role of *key* conceptual model for structuring the way we conceive of our relation to God. So, what are the implications of this suggestion for theology in general and for our concept of God in particular?

Brümmer recognizes that such depends, of course, on what we mean by “love” and how we understand the role of conceptual models in theology. Within the text of *The Model of Love* (1993), Brümmer is committed on the one hand to an inquiry into the nature of love as a personal relationship and of the various attitudes involved in this relationship. On the other hand he is committed to exploring the implications for Christian theology of using this as a model for talking about the relationship between God and human animals (Brümmer 1993, 3–4). Accordingly, Brümmer’s classificatory organization of experience constitutes our horizon for understanding the world: we seek to understand things by comparing them to similar things with

which we are already familiar (Brümmer 1993, 5). Brümmer contends that three points are important for our understanding of experience classification:

> First, the similarities and differences between things are given to us in experience. . . Secondly, which characteristics are to serve as a basis for classification is a matter of choice on the part of the classifier—a choice made on pragmatic grounds in the light of the latter's aims, interests, concerns, etc. . . . [and] Thirdly, we are only able to divide things into classes if we have developed the skill to recognize the similarities and differences on which our classification is based (Brümmer 1993, 6–7).

Moreover, Brümmer notes that when we speak of theology, it is "the fundamentally metaphorical nature of all human thought and experience" that is brought to us (Brümmer 1993, 8). He goes on, "The term 'metaphor' does not only refer to a figure of speech distinguished from literal language . . . but can also be used to refer to a basic characteristic of all our thinking . . . [In fact,] "metaphor plays an essential role in religion and in theology" (Brümmer 1993, 8, 13).

Some scholars "claim that a biblical concept of love can be found merely by looking at the way the word love is used in the Bible" (Brümmer 1993, 30). But this claim mistakenly supposes that the concept of love can only be expressed by means of the word "love" and its various cognates. However, in the bible this happens in many other ways as well, including many narratives in which love both human and divine is described or depicted without the word "love" necessarily being used at all. A more problematic supposition is that the same word in the bible always expresses the exact same concept. While there may be a familial resemblance between the concepts expressed by the same word when used by different authors and in different contexts, in no way, however, are these concepts identical. Moreover, they surely do not always have the same implications. Although the biblical authors use the word love in various contexts,

they do not ever provide a fully systematic development of the concept of love by spelling out all its implications and presuppositions, as well as its related concepts. For this reason, Brümmer avers that it is not always clear which concept of love is being expressed, let alone that it should always be the same concept. Yet a third doubtful presupposition of biblical theology is that there must be "one unambiguous biblical concept of love in the Bible" (Brümmer 1993, 31). False. Flat false.

According to Brümmer, "what we require is a relational model of love, in terms of which we can talk meaningfully about the very complex relation between God and human persons" (Brümmer 1993, 33). If we turn to the Christian tradition, we will discover to our surprise that most of the concepts of love developed within it have been *attitudinal* rather than *relational*. In fact, love has generally been taken to be "an attitude of one person toward another, rather than as a relation between persons" (Brümmer 1993, 33). So then, within *The Model of Love* (1993), Brümmer offers a thoroughly relational concept of love. Indeed, he argues that "love should be interpreted as an interpersonal relationship rather than as an attitudinal or emotional attribute of persons, as has traditionally been done" (Brümmer 1993, 34). Such a relational concept of love will enable us to show how the various attitudes that in the Christian tradition have been proposed as answers to the question "what is love?," are connected with each other since all of them are in one way or another involved in the relationship. Also, such a relational concept of love will enable me in this dissertation to explain how God the Spirit "loves into being" the various forms of complexity, relationality, and beauty in varied and multifarious forms, along with the extension of diversity and the concomitant increases of multiplicity within the natural environ.

Love, Science, and Theology Symbiosis—In Dialogue with Thomas Jay Oord

In what follows, I preserve Oord's insights into love, largely, and I mention such here so as to later build upon Oord's definition of love, wherein he asserts that it is "to act intentionally, in sympathetic/empathetic[2] response to others (including God), to promote overall well-being" (Oord 2010a, 15). Oord breaks this definition down into the following components: "to act intentionally…" means, for him, that love refers to "deliberations, motive, and self-determination" (Oord 2010a, 15), to which he adds "freedom" in *The Nature of Love* (2010b). The decisionality of love, as presented in the above definition by Oord, seemingly refers to the asseveration that a degree of mentality must needs accompany action that is regarded as loving, though this mentality need not be marked by depth and complexity. As my astute readers will surely pick up, the former sentence has explicit Process philosophical overtones. This is itself intentional, for the chapter you are now reading views Process philosophy to be the most cogent mirror of reality on tap today. I am unabashed about such a statement. So then, I will be consistently highlighting Process philosophical overtones in what follows.

Oord's next phrase, "in sympathetic/empathetic response to others," indicates that actual relationality—not just theoretical relationality—is required for there to be an instance of love shown (Oord 2010b, 42). Oord here uses the term "sympathy and empathy" in reference to love because they are "technical word[s]," which refer to the "internal, constituting influence of one or more objects or individuals on the loving actor" (Oord 2010a, 19). In so doing, he highlights the "feeling-with/suffering-with" of sympathy and empathy (this is my terminology, note). Bluntly, love is inherently relational. Love takes at least two entities, if not more. Entirely

[2] Note that Oord published two texts dealing with love in 2010: *Defining Love: A Philosophical, Scientific, and Theological Engagement* (Grand Rapids, MI: Brazos, 2010); and *The Nature of Love: A Theology* (St. Louis, MO: Chalice, 2010), the latter of which added "empathetic" to the definition of love.

isolated entities, of which I have a tendency to be at times, cannot not love fully, according to Oord (Oord 2010b, 41). In turn, I stipulate that this has direct implications to the traditional concept of the Trinity in Christianity; for if the logic of love is correct, "God" (the Father) must need necessarily an "other" to love, which at least implicates a "binity" of sorts, if not the Trinity itself (but this, indeed, is a topic for another book). Moreover, as a consequence of this "need" by God to be in relation with some other entity in order to be fully lov*ing*, established above, I even therefore promote the essentiality and necessity of there being some sort of "eternal" world to co-exist with God. But again, that is a topic for another day.

Further, creatures could not love at all if our relational God were not the lover who empowers, inspires, and beckons them to do so (see Oord 2010b, 42). Process philosopher Charles Hartshorne notes that sympathy entails "the doctrine . . . that all feeling feels other feeling, all reaction has an object which itself is reactive, [and] that we have objects at all is due entirely to the . . . immanent sociality of experience" (1975, 185). Alfred North Whitehead's (1979) contention that sympathy is equivalent to "prehension" stands out in this context as well. Further, Herbert Spencer, the great nineteenth-century Darwinian (who, perhaps, was a "Darwinian" before Darwin was) regarded sympathy as "fellow-feeling." Oord notes that his usage of the terminology of "sympathetic/empathetic" with reference to love is meant to conjure up the internally-influencing nature of love itself (Oord 2010a, 20). Further, love is a decision that is made: i.e., it is both tendential and judgmental, which is captured rather well by Process philosophers/theologians John B. Cobb and David Ray Griffin's phraseology of "creative-responsive love" (Cobb and Griffin 1976, 41–62). Oord joins these scholars in noting that love has both passive and active dimensions to it (Oord 2010a, 22). The last phrase of Oord's definition of love—"to promote overall well-being"—highlights the positive character of love's

aim: well-being. To promote well-being is to increase flourishing in at least one of the following dimensions: (1) an entity's dispositions, (2) an entity's habits; or (3) an entity's character. According to the mutuality tradition of love, "to love," so to speak, is to engage in personal interaction or relationship. Love *is* relation, invoking Brümmer's key insight mentioned above. This mutuality linguistic tradition says that the reciprocity inherent in any relationship *is* itself love.

Indeed, contemporary theologian Brümmer calls love "a reciprocal relation," and he claims that love "must by its very nature be a relationship of free mutual give and take" (Brümmer 1993, 162, 161). Charles Hartshorne offers a similar application of love as mutuality when he says that "love means realization in oneself of the desires and experiences of others, so that one who loves can in so far inflict suffering only by undergoing this suffering himself (1941, 31).[3] Invoking the symbiotic associations in biology once more, I posit that to love is to be "mutually related." In an aside, what can I further state about Hartshorne's precocious insight that "love means realization in oneself of the desires and experiences of others," referenced just above? For one thing, I contend that this means that God—the most-maximally loving entity in the (uni-)multi-verse—has "become one of us." I am here reminded of Joan Osborne's 1996 C.E. pop-music hit titled, "What if God Was One of Us?" But, it seems to me, Ms. Osborne, God has "become one of us!" However, this too is a discussion for another day. Allow me now, I bid, to broach a small discussion of what is singularly the most impressionable and therefore influential book on love in the twentieth-century: Anders Nygren's *Agape and Eros* (1953).

[3] Hartshorne, however, is inconsistent in his use of "love." Sometimes, he uses the word to speak of simple mutuality; other times he uses the word to speak of acting for the good. And, notably, he does not believe that mutuality always promotes the good.

Anders Nygren and the Threefold Delineation of Love

The fifteenth-century French philosopher Francois de La Rochefoucauld once said, “There is only one kind of love, but there are a thousand different versions” of it” (1871). Today we might say that love has trillions of versions. Indeed, love is highly pluralistic in that love is multiform and multi-expressive (see Oord 2010a, 32). What, then, might one do when approaching the study of love? Authored by the Swedish theologian Anders Nygren (1890–1978), *Agape and Eros: The Christian Idea of Love* (1953) was the most successful and influential theological book on love in the twentieth-century, bar none. Nygren therein, somewhat helpfully (I have a split opinion of his view of love, as will become evident later), divides love into three different types or conceptions: *agape, eros,* and *philia*. Throughout the world, countless students of theology and related disciplines have learned from Nygren’s book that Christian love (*agape*) stands in radical opposition to both the Greek concept of *eros* and the Jewish treatment of love in law (*nomos*) (at least according to Jeanrond 2010, 113). Nygren’s main contention within this book is to elaborate on how “*agape* and *eros* are contrasted with one another . . . as Christian and non-Christian fundamental motifs” (Nygren 1953, 38). Moreover, he is concerned with how “an admixture of the *eros* motif has weakened the *agape* motif and rendered it more or less ineffective” throughout history (Nygren 1953, 38–39).

Nygren distinguishes sharply between two irreconcilable concepts of love, namely the Platonic and the Christian. He identifies the Platonic understanding of love in terms of *eros* and the Christian in terms of *agape*. *Agape*, the word most frequently used in both the New Testament and in the Greek translation of the Old Testament, is charged here with a different, particularly Christian meaning. Namely, it is charged by Nygren to be the belief that Christian love itself comes from God (Jeanrond 2010, 114). According to Nygren (1953, 205),

> *Eros* and *agape* are the characteristic expressions of two different attitudes to life, two fundamentally opposed types of religion and ethics. They represent two streams that run through the whole history of religion, alternately clashing against one another and mingling with one another. They stand for what may be described as the egocentric and the theocentric attitude in religion.

They are essentially opposites of one another because "*Eros* is an upward movement . . . [whereas] *agape* comes down" (Nygren 1953, 210). In fact, in *Agape and Eros* (1953), Nygren pursues a twofold aim: (1) he wishes to expose *eros* as that human form of egocentric and desiring love which strives to reach the divine sphere by its own strength; and (2) he recommends *agape* as that form of love which originates in God and therefore requires a human attitude of receptivity and passivity. An erotic attitude focuses on something that is of great attraction and value to us human beings and thus causes desires in us, whereas *agape* is addressed to every human being and as such creates a value in that being (Nygren 1953, 78). *Agape* is God's way to humankind (Nygren 1953, 81). For Nygren, there "cannot actually be any doubt that *eros* and *agape* belong originally to two entirely separate spiritual worlds, between which no direct communication is possible" (Nygren 1953, 31; also, see Jeanrond 2010, 114–15).

So then, Nygren distinguishes sharply between two irreconcilable concepts of love, namely the Platonic and the Christian. He identifies the Platonic understanding of love in terms of *eros* and the Christian in terms of *agape*. As such, *eros* is the aspiration of a lower drive toward a higher drive. *Eros* is the attitude of *eudaemonism*.[4] *Agape*, on the other hand, is the attitude of the higher entity stooping down in service to the lower entity (Brümmer 1993, 128).

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[4] This cumbersome term means simply that we are to pursue the highest ethical goal, which is happiness.

Notably, Colin E. Gunton signals that Nygren's assertion of *agape* against *eros* is blatantly one-sided in orientation; while Gunton concedes that *agape* at times represents God's self-giving in Christ, to stress that alone—he contends—leads to an almost individualistic unrelatedness (1997, 114). Indeed, for Nygren, *agape* is essentially the love of God who, in his grace, stoops down *toward* human persons in order to save them. Nygren states: "There is thus no way for man to come to God, but only a way for God to come to man: the way of divine forgiveness, divine love. *Agape* is God's way to man" (Nygren 1953, 80–81). Secondly, *eros* is born from want, whereas *agape* from abundance. In fact, for Nygren, "*Eros* is the will to get and possess which depends on want and need . . . *agape* is freedom in giving, which depends on wealth and plenty" (Nygren 1953, 210). *Eros*, then, is need-love which is motivated by the desire for what it lacks, whereas *agape* is gift-love which flows spontaneously from its own abundance. Thus, God's love for us is not *eros* but pure *agape* instead.

In fact, "*Eros* is yearning desire; but with God there is no want or need and therefore no desire nor striving. God cannot ascend higher . . . Since *agape* is a love that descends, freely and generously giving of its superabundance, the main emphasis falls with inescapable necessity on the side of God" (Nygren 1953, 212). Therefore, for Nygren, God's love for us has its origin in Godself. That is, it has its origin in the abundance of God's own *agape*, and not in us (Brümmer 1993, 129). Thirdly, *eros* is inherently conditional, whereas *agape* is completely unconditional, for Nygren. *Eros* is the love I have for the other because the other has potential to either realize the good within me, or enables me to achieve the good. As such, it is conditional on the other having this potentiality. That is, I can only desire goodness from you (i.e., who- or whatever it is) on condition that you have this possibility. *Agape*, on the other hand, is unconditional since it is not motivated by the qualities of the other, but by the abundance of the giver instead. Indeed,

eros is determined by the quality—or beauty and worth—of its object, and is not spontaneous. Instead, it is "evoked," whereas *agape* is directed to both "the evil and the good," and is therefore spontaneous, "overflowing," "unmotivated" (Nygren 1953, 210). This situation applies especially to God's love for us humans. God's love is "groundless"—not in the sense that there is no ground for it, or that it is arbitrary, but that it is shown to us based upon no extrinsic grounds for it (see Brümmer 1993, 130). At this point, a further difficulty surfaces in Nygren's view of love. And this is the seeming fact that it is incoherent—to me at least—to claim both that *agape* bestows value on its object, and that it is indifferent to the value in the object. After all, the fact that I am loved by an "other" indeed bestows a value on me which I would not have had lest I be loved by that other entity. It is not clear whether the *agape* that Nygren conceives is the kind of love which can do this (see Brümmer 1993, 131).

Another problem of Nygren's modeling of "love" concerns the nature of God's love for us. For the same reason as Plato and Augustine before him, Nygren denies that God's love for us can be of the *eros* form. He says as much in writing: "With God there is no *want* or *need*, and therefore no desire or striving" (Nygren 1953, 210; my italics). On the contrary, for Nygren, God's love is pure *agape*, and that for two reasons: (1) God's love is *agape* by definition—"All love that has any right to be called *agape* is nothing else but an outflow from the divine love. It has its source in God. 'God is *agape'*. This, too, is a simple consequence of the meaning of the word *agape*" (Nygren 1953, 212); (2) this is a "real definition," in that it is not a mere contingent fact about God that he is *agape*, but a necessary consequence of his essential nature as the superabundant love behind, before, and for all things—"Since *agape* is a love that descends, freely and generously giving of its superabundance, the main emphasis falls with inescapable necessity on the side of God" (Nygren 1953, 212). This view on God's love and lov*ing* raises a

couple of blatant difficulties. I mean by this assertion that if Nygren holds that there is in God "no need or want or desire," then God cannot *need* nor *want* nor *desire* that we return his love. This would mean, then, that God would be unable to receive our love in any meaningful sense, as well, which is an incoherent and an abominable assertion, for God would then care *for* us but not *about* us (see Brümmer 1993, 132).

Another "dimension of love" discussed by Nygren is our love *toward* God. Nygren stipulates that this can very well be *eros*. He writes: "Human want and need seeks for satisfaction in the divine fullness. *Eros*-love is acquisitive desire, appetite, which as such strives to obtain advantages. Since God is the Highest Good, the sum of all conceivable good or desirable objects, it is natural that he should attract to himself all desire and love" (Nygren 1953, 212). Strictly speaking, this means that our love for God cannot be *agape*, since "*agape* is spontaneous, unmotivated love. But in relation to God, man's [sic] love can never be spontaneous and unmotivated. God's love always comes first and awakens man's love in response" (Nygren 1953, 213). For Nygren, this is because our love for God is always motivated by an extrinsic cause in God. Nygren thus doubts whether *agape* can appropriately be used to denote a human's attitude toward God. In relation to God, people are never spontaneous—we are not independent centers of activity. Hence it lacks all the essential marks of *agape*.

All forms of *eros*, however, aim at self-realization and are therefore expressions of self-love. Unlike *eros*, *agape* "excludes all self-love. Christianity does not recognize self-love as a legitimate form of love . . . It is self-love that alienates man from God, preventing him from sincerely giving himself up to God, and it is self-love that shuts up man's heart against his neighbor" (Nygren 1953, 217). In brief: according to Nygren, in all cases *eros* equals self-love, and *agape* in all cases is God's love toward human beings. The most we humans can hope to be

is impersonal "reservoirs" or "canals" by which God can let his *agape* flow to the world. But then, it seems to me, we are *not* the ones who love in any endeavor. Rather, God does all the loving—*he* loves through us—and we do nothing. Nygren's claims make the Christian faith explicitly deny that human beings are "independent centers of activity," and as such, it denies that they are independent persons (Brümmer 1993, 137). Because the problem of love is whether and how there can be a self-denying and sacrificial love for others which is at the same time fulfilling and perfective of oneself, Nygren only admits two extreme forms of love which he claims are mutually exclusive. On the one hand, we can love other entities and God with a love of *eros* in which we love them out of self-interest in order to acquire and possess them; or, we can love other entities and God with a love of *agape* in which we reject all self-gain and interest and surrender ourselves to others and love them purely for themselves. Thus, Nygren presents us with an unbridgeable dichotomy: either we love other entities and God purely for ourselves in which case we do not really love either God or other entities at all. Or, we love them for themselves with a true love in which case we act against our own self-interest and happiness.

Pierre Rousselot, in *The Problem of Love in the Middle Ages* (2012) however, presents his own threefold distinction between forms of love. First, he mentions a view that corresponds to Nygren's *eros* in which various entities love others and God solely as a way by that particular entity to love itself (Rousselot 2002, 77). Here all love is reduced to the love of self, or to the love of desire. According to Rousselot, this "egoistic view of love," that is, when humans love God purely as a means to the love of self, was not encountered in the Middle Ages. Therefore, such a "display of love" is only a condition of modernity post- (Rousselot 2002, 13–14). Second, Rousselot discusses the "ecstatic" conception of love that corresponds roughly with Nygren's *agape*. He describes the "ecstatic" conception of love as the view that severs all the connections

linking the love of other entities to one's egoistic inclinations (Rousselot 2002, 79). Accordingly, under the ecstatic conception, love becomes a relationship between two entities that have no natural relation to each other (Rousselot 2002, 83). Third, the "physical" conception of love holds that there is a fundamental identity between the love of self and the love of other entities or God. Thus, the "physical" conception of love is characterized by unity, not duality as in the ecstatic conception of love (Rousselot 2002, 155). Herein humans find their own good in the love of other entities and God. That is, they fulfill their own nature(s), thereby, in this way. Thus, in the physical conception of love, the love of desire and the love of friendship are in perfect continuity. The love of other entities is in accordance with one's natural inclinations and tendencies. Indeed, the more one gives oneself to other entities, the more one finds and gains oneself (Rousselot 2002, 169).

Rather than the definition and elaboration of *agape* that Nygren gives us, I would like to propose the following litany of terms as descriptive of God's *agape* love (if we are forced to even use that term; more on this later): *agape* love is, according to Reinhold Niebuhr, a "self-sacrifice" (Niebuhr 1964, 2:82). Moreover—and I truly appreciate this definition due to my perspective and reimagining of the oft-used but rarely understood term *kenosis*—it is a "letting-be" according to John Macquarrie (1977, 349). Further, it is a representation of "the divine extravagance of giving that does not take self into account," says Colin Grant (2001, 188). It is also, in another definition that I particularly appreciate, "God giving himself," or even a "divine bestowal," according to Irving Singer (1987, 269). Finally, I encounter yet another definition that I greatly appreciate in the one according to Paul Fiddes, who claims that it is "self-giving," insomuch as a person "spends himself freely and carelessly for the other person" (Fiddes 1988, 170). I would now like to appropriate many of the just mentioned senses of the word *agape* for

my own purposes in joining Tom Oord, building on the previous section, in picturing God's love as always "self-giving." Thus, I would not divvy love up into various "types"—be it *agape,* or *eros,* or *philos,* at least ideally (see Wagoner 1997, 112).

Thomas Jay Oord's "Full-Orbed" Love More Pointedly Explicated

Indeed, I follow Oord in noting that *agape* is simply one form of love, according to the biblical witness, and as such it is not the be-all, end-all substance of love. *Agape* is just one out of a multitude of ways that entities may self-givingly and intentionally respond to other entities to promote well-being. *Agapastic* love, to invoke the Peircean terminology of a previous chapter, may well be the "full-orbed" love that Oord mentions in his two texts from 2010 C.E. (see, e.g., Oord 2010a, 52; and Oord 2010b, 41). However, I would prefer to refer to it as, at least once, "full-Oorded" love. In my conception, "full-orbed" love would encompass what is ordinarily contained within the definition of *agape* love, but it would also include "*eros* love," for the latter is the love of co-laborment. Indeed, Martha C. Nussbaum says that *eros* "involves an opening of the self toward an object, a conception of the self that pictures the self as incomplete and reaching out for something valued" (Nussbaum 2001, 460). Thus, when *eros* is expressed, the responsive, affective, or emotional element in love exerts considerable influence. However, "intentionality" is never completely absent (cf. Oord 2010a, 46). This picturing of "*eros* love" as a form of co-laborment will become more acute later.

We are *not* just "reservoirs" of love, as Nygren would state. We are also generators of self-donating, self-giving, *kenotically*-donated love! Oord and Wojtyla would entirely agree with this contention, for the *kenotically*-donated, self-donating and self-giving love, as I envision it, is inherently relational. But it must not be seen to be only a "desire;" in fact, Oord uses the term *eros* to mean that which "acts intentionally, in sympathetic/empathetic response to others

(including God), to promote overall well-being when affirming what is valuable, beautiful," lovely, and excellent. In other words, it is an intentional response to promote overall well-being when affirming that which is valuable. Self-giving, it should be noted, is the central aspect in Eberhard Jüngel's reflections on God as love. In his major work, *God as the Mystery of the World* (1983), Jüngel approaches love from a Christological and a Trinitarian perspective. He takes his point of departure in the terminology and understanding of the Johannine community. The insight and subsequent confession that "God is love" is intimately linked to the interpretation of the cross of Jesus of Nazareth, as the event in which God's self-giving in love for other entities is most maximally expressed. As a result, Jüngel can say that it is the task of theology to think of God as love (Jüngel 1983, 315).

Although Jüngel rejects Nygren's strict separation between both aspects of human love, he recognizes a difference in intention between *agape* and *eros*. While *agape* loves *eros*, *eros* does not love *agape* (Jüngel 1983, 338). Jüngel fittingly notes, "To speak of the transforming power of the fire of love, which is requested together with the prayer for the coming of the Holy Spirit, is both the critical and soteriological point of the statement 'God is love'" (Jüngel 1983, 329). According to Jeanrond, Jüngel both affirms this identification and confirms the essential difference between human love and divine love: i.e., God makes the "object of his love" first of all worthy of his love, as the love flowing from the cross makes the ugly person beautiful in the eyes of God (Jeanrond 2010, 130). For Jüngel (1983, 358), Christ's self-giving (that which I have labeled *kenosis* since 2008 C.E.) is the ultimate qualification of love. I heartily agree with Jeanrond, for he indicates that God's "self-giving love" manifest in Jesus the Christ and the Spirit of Christ "defines love once and for all" (Jeanrond 2010, 132).

My understanding of “full-orbed” love would also include dimensions of *philia* love. *Philia*, if we must retain the differentiation, could be akin to mutualism or commensalism in biology, especially since *philia* love has historically been associated with friendship or the interrelatedness of the natural world. Notably, Aristotle (2002, 1155a) indicates that even nonhuman animals can express *philia* love. The relationships marked by *philia*, then, could be identified by mutuality, reciprocity, and cooperation, which fits the above biological connotation well. While *agape* or *eros* might benefit from cooperation, reciprocity, and mutuality, those two forms of love do not require any of those three nouns. *Philia* does, flatly. I contend, in fact, that God’s *kenosis* of the Spirit *into* the natural world amounts to self-giving, betrothed love through self-donation. Several years ago, a collection of essays by scientists and theologians, edited by John C. Polkinghorne (2001a), pondered “creation” as *The Work of Love: Creation as Kenosis,* pointing therein to divine “action” as *kenosis*. Note that while I prefer the nomenclature of “involvement,” I here keep the “action” language because the authors themselves used such. In this volume, it is asserted that the Spirit has chosen to invite the natural world into a *cooperative* relationship, which also coalesces well with Wojtyla’s conception of love as self-donation. Further, because the love of God is uncontrolling, it always donates freedom, agency, and self-organization to the “other,” and thereby God sustains the regularities of nature (Oord 2015, 95).

Notably, even *after* Darwin, Petr Kropotkin, in his *Mutual Aid: A Factor of Evolution* (1902), indicated that cooperation is everywhere present within the natural world. It is an important argument because such belies the oft rehearsed “selfish” nature of Darwinian evolution. Kropotkin, for example, spent years studying organisms and other entities within and upon frozen ice in Siberia. He notes,

> Wherever I saw animal life in abundance, as, for instance, on the lakes where scores of species and millions of individuals came together to rear their progeny; in the colonies of rodents; in the migrations of birds which took place at that time on a truly American scale along the Usuri; and especially in a migration of fallow-deer which I witnessed on the Amur, and during which scores of thousands of these intelligent animals came together from an immense territory, flying before the coming deep snow, in order to cross the Amur where it is narrowest—In all the scenes of animal lives which passed before my eyes, I saw mutual aid and mutual support carried on to an extent which made me suspect in it a feature of the greatest importance for the maintenance of life, the preservation of each species, and of its further evolution (Kropotkin 1902, 5).

Kropotkin goes on,

> Besides the law of Mutual Struggle there is in Nature the law of Mutual Aid, which, for the success of the struggle for life, and especially for the progressive evolution of the species, is far more important than the law of mutual contest. This suggestion—which was, in reality, nothing but a further development of the ideas expressed by Darwin himself in *The Descent of Man* [1872]—seemed to me so correct and of so great an importance, that since I became acquainted with it (in 1883) I began to collect materials for further developing the idea (Kropotkin 1902, 6).

The union, then of *agape*, *eros*, and *philia* love could be expressed as “mutual aid” (cf. Kropotkin), or “full-orbed” love (cf. Oord). But again, that is only if we are absolutely resigned to continue to employ those three terms, for as Edward Collins Vacek (1994, 310) notes, “Life typically includes all three loves in rhythmically occurring ways.” I would prefer not to retain them at all, however, and merely employ the terminology of “self-giving” love instead.

Flourishing lives, I aver, consistently express self-giving love. So why do I not want to retain these three Greek words for contemporary discourse about "love" itself? Simply because: (1) there is no reason to do so, and (2) the keeping of these Greek variations of the word "love" only extends obfuscation, and does not at all clarify the issues surrounding what is—in fact—able to be united from these three independent Greek words about the modality of "love" in the contemporary context. Indeed, various problems arise when we regard *agape* love as the authentically Christian love, to the exclusion of either *eros* or (and?) *philia*. One problem is rather straight forward, and even a little menial: bluntly, there is just no basis for it whatsoever! Sometimes authors of the New Testament seemingly place *agape* on a different "plane" of status and regard, whereas at other times they simply do not. The New Testament witness is erratic, and at most unreliable if one tries to use it as a basis of extrapolating the meanings of the various "love words" (Wagoner 1997, 112). To be sure, sometimes New Testament writers use *agape* in a "higher" sense, but almost as many times they simply do not. So, to attempt to base one's entire distinction of these three regularly used words within the Judeo-Christian corpus on the variety of usage itself is—plainly—sloppy and shoddy scholarship. Sometimes the writers of the New Testament use *agape* as the highest form of love, sometimes they use *philia* as such. And so on.

There is, simply, no rhyme or reason with regard to their employment of either *agape*, *eros*, or *philia* "love." Not simply with respect to the New Testament, but truly all of ancient literature almost indescribably uses these three terms for "love" indiscriminately, insomuch as it is hard to know what a particular ancient writer means by "love" simply by looking at the word employed. Similar problems arise when we look at texts pre-dating Nygren's *Agape and Eros*. In fact, Robert Merrihew Adams notes that "'Agape' is a blank canvas on which one can paint

whatever ideal of . . . love one favors" (Adams 1999, 136). *The Journal of Religious Ethics*, in a somewhat recent instance (1996), devoted an entire issue (24.1)[5] to a delineation and discussion of these three love "types": *agape, eros,* and *philia*. One author would argue for the distinction, and then one would argue against it, almost in whip-like fashion. For example, Colin Grant defended Nygren's thesis that there is a *bona fide* distinction between these three forms of love: *agape, eros,* and *philia* (Grant 1996: 3–21). He noted that *agape* is the highest form of love. Thereafter, Carter Heyward argued that feminists like herself hold that *eros* could and should displace *agape* as the preeminent form of love (Heyward 1996). Then, Edward Collins Vacek defended the idea that *philia* love deserves the highest honor (Vacek 1996). This small sample size, though not at all statistically significant, nevertheless demonstrates that a scholar working on love research has to have his or her discernment on tap, so to speak, when working with this topic.[6]

Oord himself suggests that Process philosophy can aid one to see that all three forms of love play an important part in the work to increase the common good of society as a whole. He posits such under the rubric of "full-orbed" love. "Full-orbed" love repays evil with good as *agape* would. Such a "full-orbed" love also appreciates the intrinsic value and beauty in other entities, just like *eros* love does. And "full-orbed" love acknowledges the import of friendship and mutuality as does *philia* love. Building upon my own writings, Oord, and Wojtyla again, since God commands that we show "self-giving," "self-donating" love, we (late-)modern Homo species therefore indeed have the ability to love others as *kenotically*-donating entities, just as Godself does. When we act as a genuine conduit and amplifier (note not simply a "channel" or

[5] *The Journal of Religious Ethics* 24, no. 1 (Spring 1996).

[6] I have been aided in this paragraph by Oord's essay, "Process Answers to Love Questions," in *The Many Facets of Love: Philosophical Explorations*, ed. Thomas Jay Oord (Newcastle, UK: Cambridge Scholars, 2007), 20–30.

"reservoir," as Nygren would say) of God's self-donating and self-giving love, we can truly and entirely and infinitely love others, just as God does. Therefore, self-love is transformed by God's impartation of self-donating and self-giving love. Further, through that impartation, we humans are empowered—*kenotically*—to love others in a manner akin to how God loves us. In this manner, we may say that "since the beginning, the myriad creatures have been giving up their lives as a ransom for many". . . "The cruciform creation is, in the end, deiform" (Rolston 2001, 59). This characteristic of *kenotical* empowerment is because of the struggle *and* mutual aid inherent within evolution by natural selection, not in spite of them. If contemporary humans cannot truly and authentically love, we are of all creatures the most to be pitied. Invoking the distinction that C. S. Lewis originally gave us—i.e., between "need love" and "gift love" (Lewis 2017, 3), which is also appropriated by Vincent Brümmer in *The Model of Love* (1983)—I would like to close this section by saying that Lewis is at least half right. There is a "gift" love, and it is a mark of all of hominin lives in that we can, *kenotically* empowered by God, self-donate and self-give our very being-ness to others via *kenotical*-donation, just alike unto how God always does it. Of course, we cannot expect that we humans (or other entities) will always love alike unto how God does because we do not have an eternal and unchanging nature that is necessarily inclined toward love (cf. Oord 2015, 77), but we are at least always *able* to do it.

A Bradfordian Proposal—The Exaltation of *Eros* Love

I would like to now transition to one of my own proposals. Far from it being discouraged as "selfish" (a 'la Nygren) or even considered to be "need" love (a 'la Lewis), I submit to my reader that we should exalt *eros* love. This simply because through *eros* love, we (late-)modern hominins have attained our mastery over all other entities within the natural world—and in fact—have unfolded (*evolutio*) into the status that we are in during this (late-)modern period

because of it. Indeed, I posit that due to human's inherent expressions of *eros* love, they have evolved into the pinnacle of God's creativity through the Spirit. Not only humans, however, but truly all of the Spirit's "creation" has been maximized by the inherently driven nature of *eros* love. Meaning, then, that *eros* love is the empowerment of the unfolding processes of (macro-)evolution. In my appropriation of this terminology of *eros* love, it would be the type of love that has the desire to, for example, expand one's territory or one's domain, which makes it applicable to the (late-)modern theory of evolution by natural selection. Evolution—i.e., "descent with modification," to invoke a Darwinian phrase—then, recognizes self-giving love, and the goodness thereof, in that species regularly undergo commensalist relationships in nature. This commensalism, as previously alluded is a relation between two entities (or more) wherein one is aided by the other, while the "other" is neither "aided" nor "harmed." This is self-giving, amorepotent love in its entirety, and a proper demonstration of it.

So then, instead of minimalizing *eros* love, I bring it to the forefront of the evolving processes on earth, and thereby bestow upon it a high value and importance not given to it by the majority of Christian history. Let me state my proposal very plainly: *eros* love is the means by which the advancement of species is educed, evoked, and effected. Therefore, *eros* love should not be dismissed on a whim, but rather, celebrated by all comers. Indeed, we can perceive *eros* love in the manners in which species attempt to maximize their territory. We can also perceive *eros* love by the manners in which species promulgate themselves—which in fact—is the cornerstone of an unfolding (*evolutio*) species. So then, far from being disbarred—or even relegated to a small corner in a very large room of life—*eros* love is the very reason why we have the extensively evolved entities in the natural world of this day. This means further, that instead of *eros* love being viewed primarily as "selfish," and hence unbecoming of creatures

endowed by God with his "image," it should be un-hesitantly lauded (for further elaboration of this point, please see McCall 2021a, the proposal for which is currently being evaluated by Wipf and Stock). This efficacious divine involvement through the Spirit is, then, based upon the concept of *eros* love. My patient reader might well remember that I termed this notion, above, as "*kenotically*-donated, self-giving divine involvement through amorepotent and uncontrolling, contingentist emergence and punctuated equilibrium."

Unpacking such fully, I now stipulate that there is divine involvement through a creative synthesis of contingent events and the underlying laws (or "habits") of nature, amounting to contingentist divine activity *via* a heavily modified notion of structural forms, which is pneumatically (i.e., Spirit) derived. The Spirit, in this conception, works with matter and the entities that originally derive from matter through *eros* love. I stipulate such because in the historic conception of *eros* love, there is a definite longing, or even "need" (according to Nygren) in the entities that derive from God. I further stipulate that this "longing" is for further and "higher" unfolding, that is, (macro-)evolution itself. So then, the compulsion to erotically love is in fact the propulsion behind the advancement(s) of species. Additionally, I above stipulated that divine involvement is evident through realizations of punctuated equilibrium, meaning that there is contingentist divine activity *through* punctuations, which is further Spirit derived. I would now like to apply this understanding with reference to *eros* love, as well. I contend that these punctuations, as evident in the fossil record, were educed—in geological (deep) time at least—by the longing and yearning of the natural world, and all entities that pervade it, to reach the maximization of their own potentiality. That is, matter was and is driven, if you will, through matter's own erotic desire to maximize its own complexity, beauty, relationality, and diversity, *et cetera*. So then, one can easily perceive that I advocate the non-

sentient realm of the natural world has its own agency, and therefore is not merely inert "matter." Thirdly, I stipulated above that there is divine involvement through instantiations of amorepotent, uncontrolling *kenosis*, which amounts to contingentist divine activity *by* self-giving love, which further is also pneumatically derived. I now appellate the involvement of the Spirit in this uncontrolling *kenosis* in the unfolding of the natural world to be directly attributable to the Spirit's own *eros* love (or, say it with me: "erotic love"). Indeed, because the Spirit longs for and desires the natural world to advance in complexity, beauty, relationality, and diversity (etc.), God—through the Spirit, it could be said—bestows the "goal" of the expression of *eros* to all entities in the natural world, which seamlessly coalesces with the above second point, as well.

So then, there is definite *kenotical* creativity through cosmological causes, which is a direct result of God's *kenosis* of Spirit *into* the natural world, which also amounts to (a sort of) Spirit-derived causation (SDC)through her mutual immanence and contiguity with the natural world. This SDC also is the direct result of the concurrent bestowal of the desire for *eros* love to all entities that fill it. I contend this mutual relation is constituted, succinctly, by the amorepotent, uncontrolling *kenotical* Spirit. Thereafter, endowed and empowered by the Spirit of creativity, the creative advance into the future—which is both entity-created and entity-directed—is effected by and through the general "goals" that God lays-out. These "goals" of God, in turn, lure the natural world forward—ultimately—to Godself. All of the preceding affirms indeed that (macro-)evolutionary pathways reside within the parameters of God's amorepotently loving intentions. Prior to closing this section, I would like to frame my proposal of "the exaltation of *eros* love" with reference to the formalist vs. contingency debate that I have explored throughout this dissertation.

As aforementioned in my statement of the problem that this dissertation seeks, in part, to rectify, Gould essentially douses one heavily in functional adaptationist views and historical contingency, while providing strokes of formalism. However, after going through the entirety of my developed theses in this book, I think I may have shortchanged the “formalist side” of Gould. I say this because, at the end of my journey herein, I now realize that Gould’s “structuralism” is much more pronounced than I had earlier conceived it to be. Indeed, if my careful reader will notice, almost every-other comment about Gould in this dissertation, has reference to some form of formalism. This fact is seemingly strange to me, though, for I did not seek to overly and overtly emphasize this “structuralist side” of Gould, when I initially set out on this hefty endeavor known as one’s dissertation. With that said, allow me to write more fully about how my conceptioning of *eros* love, that which I have putatively exalted toward the close of this chapter, intersects and ultimately feeds off of the contingency of Gould and formalism in general, along with how I attempt to resolve that debate, insomuch as I am able.

In chapter 2 of this dissertation, I emphasized the notion that Charles Darwin helps unite insights from both sides of the age-old debate between functionalist and formalist biologists, noting how the functionalists typically place(d) enhanced value upon traits that exist(ed) for utilitarian reasons as adaptations, whereas the formalists/structuralists stress(ed) the structural unity of type common across similar organisms. I then noted that this division between functionalist and formalist biologists was “permanently undermined” when Darwin showed that structures had evolved through natural selection, although these structures may indeed be constrained by, and in fact further constrain, the evolutionary pathways available to organisms thereafter (see chapter 2). I am thinking now, toward the end of this dissertation journey, that I may have phrased that “permanently undermined” comment a little too strongly. Indeed, after

going through this process of dissertating on Gould et al., I have found it to be true that the conception of formalism, much alike to progress (see chapter 3), will not simply "go away." So then, this either means one of two things, to me. For example, it could mean that contemporary biologists who advocate a formalistic/structuralistic notion are simply hanging on to the past, so to speak, and are thereby deluded by it. Or, it could mean that this modern revival of formalist/structuralist thought is really on to something. As of this writing in mid-2021 C.E., I see the latter option to be more valid than the former.

The postulation of formalism—in morphology at least—views discontinuity as inherent in the structure of all inhabitable space. The correlation of formalism with commitment to internal constraint is, in my current view, positive in the sense of channeling change, and not merely in the negative sense of restriction. Accordingly, internal form is to be seen as a primary source that gets "honed" by external conditions, such as adaptation(s). Adaptation(s), then, shape or (re-)shape a range of diversity from an underlying form, but the original pattern itself cannot be explained finally and fully by these secondary modifications. This is simply because the adaptations themselves only express a superficial restructuring of inherent order. So then, it seems to me, most formalist theories of morphology picture adaptation as secondary "tinkering," rather than primary structuring. Thus, I would like to emphasize the primary correlation of formalism with its commitment to internal constraint in the positive sense of channeling change, and not in the negative sense of constraint as restriction. That is, perhaps natural selection and adaptation(s), themselves, are to be pictured as "Search Engines," alike to what Conway Morris stipulates them to be in his latter writings (see Conway Morris 2015, as discussed in chapter 4 of this work).

While formalist commitment directly implies an aversion to primary explanation by adaptation, function, or final cause (i.e., teleology), I rest upon the mighty Darwinian known as Asa Gray, who in 1874 CE., astutely noted that Darwin's hypotheses (at the time) meant that "instead of morphology vs. teleology [i.e., functionalism], we shall have morphology wedded to teleology" (note Asa Gray's letter, earlier referenced in chapter 2). Further, while Darwin supported a semblance of the concept of constraint, his own views were that constraint could be valid in (macro-)evolution only if it is contained within a category subsidiary to natural selection in relative frequency. Moreover, while the old(er) unity of type theorists, lacking the alternative of "just history," falsely assumed that deep homology must stand against adaptation, nevertheless, much "weight" is still placed upon the principles of laws of growth, rules of architecture, nature of materials, *et cetera*, as working in the processes of (macro-)evolution. They are seen, in fact, as important interior channels of constraint in the positive sense that they once set—and continue even now to set—preferred channels of change. Internal forces, then, actually indeed guide the external force of natural selection. Constraint, therefore, does not exist as a subsidiary to adaptation, *per se*. While constraint may never be able to claim primacy, as the old unity of type theorists held, in my own opinion, a certain type of "partnership" with adaptation is something that (late-)modern biologists should strive toward. As such, I contend that while a current trait in any population of species may arise as either: (1) an adaptation to the species surrounding environments; (2) or a constraint not particular to a species' contingent history; and even (3) by inheritance through phylogenetic constraint, only the latter is the most accurate depiction of reality. So then, though the temporary triumph of Darwinian functionalism erased much memory regarding the old alternative of constraint with the elevation of certain elements within the Modern Synthesis, I see it as our current need as professors of

(macro-)evolution to reinvigorate constraint as a vital topic. This is especially needed in view of the advancing knowledge of (macro-)evolution.

This advancing field of (macro-)evolutionary study requires, then, that we (late-)modern biologists re-discover this legacy of structuralist thought, and thereby recognize that the entire history of evolutionary theory has been pervaded by an issue that simply would not disappear. This is because the dialectic of inside vs. outside, structure vs. function, formalism vs. adaptation, must be resolved by an enriching interplay of each opposing dichotomy just mentioned. With the attributes of purpose and order as part of any biologist's heritage, the basic explanations for organic form cannot be encompassed by the structuralism vs. functionalism, spontaneous order vs. teleology, laws of form vs. adaptation, unity of type vs. conditions of existence dichotomies, *et cetera*. As I relayed in chapter 2, these bipolarities of poles set the dichotomy that Darwin presumably split by introducing "just history." However, the formalist alternative—embodied in what is now generally called "constraint"—provides a counterweight to stabilize the primacy of adaptation through its power to highlight internally-directed routes of (macro-)evolution through morphospace (see Brian Goodwin and Stuart Kauffman for examples of this type thinking in [late-]modern biology). So how do all of the aforementioned contentions relate to my advocation of the exaltation of *eros* love?

I earlier made the postulation that because of Homo species' inherent expressions of *eros* love, we Homo sapiens *sapiens* have evolved into the pinnacle of God's creativity through the Spirit. Not only us humans, however, but truly all of the Spirit's creative marvels have been maximized in their complexity by the inherently driven nature of *eros* love. This contention means, to me anyway, that *eros* love is the empowerment of (macro-)evolution. As above alluded to, the correlation of formalism with commitment to internal constraint is positive in the

sense of channeling change, and not merely negative in the sense of restriction. Therefore, internal formalism is best seen as the primary source morphology, which later gets “honed” by external conditions, such as adaptation(s). Adaptation(s), then, re-shape the range of diversity from an underlying form, but the original pattern itself cannot be explained finally and fully by these secondary modifications, insomuch as the adaptations themselves only express a superficial “tinkering” of inherent order. So… the question remains, where did this inherent “order” come from? Is it: (1) internalism generated by Platonic forms (cf. Conway Morris); (2) internal formalism generated by “order for free” (cf. Stuart Kaufman); or, (3) ultimately derived from God himself? Personally, in keeping with the anticipated conclusions as stipulated in the introduction to this dissertation (i.e., chapter 1), I assert that it is—necessarily—the result of the “imbibification” of Spirit into matter.

That is, it is due to the process by which some entity is imbibed by the Spirit of God. So then, I contend that this “inherent order” is constituted and enacted by the *kenosis* of the Spirit into the natural world at the Big Bang, which onset the distinctly panentheistic relationship betwixt God and the natural world. Moreover, then, the fascinating interplay of formalism and functionalism, above noted by Asa Gray, is succinctly constituted by the imbibified creative Spirit. The creative Spirit’s erotic love specifically, then, is highlighted by me. In so emphasizing the erotically loving and inherently creative Spirit, I note that due to her nature primarily being *kenotically*-donated and amorepotent, self-giving love, the creating Spirit *cannot* control other entities, be they animate or not. However, the dynamic lure of the amorepotently creative Spirit woos, bids, and beckons entities toward herself at the *eschaton*, wherein God will be all in all. These assertions of my own have further ramifications as particularly relevant to the notion of

contingency being ever-present in the evolutionary epic. I point my reader to my concluding chapter 7 of this dissertation for a summation of my amplified views regarding these corollaries.

McCallian Disagreements with Oord

While I—perhaps ignorantly?—assert that I established priority in the picturing of *kenosis* as self-offering, self-donating, as well as donation to the other (see above citations), one of the more well-known positions regarding (nearly) the same concept, is that of Thomas Jay Oord's depiction of "Essential Kenosis."[7] For a number of reasons, however, I have problems with the way that Oord appropriates the term "*kenosis*" in his writings, many of which I will point out in what follows. After nearly fifteen-years of thinking-through this notion of "*kenosis*," I nevertheless have come to prefer the meaning of *kenosis* as "self-giving" in contradistinction to the other alternatives I listed above. I have come, therefore, to believe "self-giving" better describes the inherently relational nature of what I refer to as amorepotent love, both in terms of the divine bestowal of it and the response(s) of entities to it. I stipulated in my introduction to this dissertation that I will partially criticize Oord for his underdeveloped theory of divine involvement. After all, if all things are done in and through love, what then is actually done?—that is, what is distinctly done by love, versus what is not done by love (so to speak)? If all things are loving, how might one distinguish it, in other words? I have come to the point, now, where I would like to make good on my introductory words.

Oord, for example, notes the following: "Out of love, God created the universe. Out of love, God sustains creation and will redeem all things. God's self-giving love makes possible creaturely agency, freedom, value, and relationship" (Oord 2010b, 179). So, for Oord—

[7] See, for example, Oord 2010b, 126–170, and 171–222, respectively; and Oord 2010a, 173–212. On the historical debate of *kenosis*, see: Brown 2011; also, for recent (partially) helpful texts on *kenosis*, see Colyer 2013; Evans 2006; and Polkinghorne 2001a.

seemingly—all things by God are done either by or through love. I disagree. Let me count the ways. That said, however, Oord and I do agree on many aspects of *kenosis*. Indeed, Tom and I have both pointed out the difficulties of, for example, John C. Polkinghorne's interpretation of it to be a voluntarily self-limitation on God's part. Polkinghorne says, for instance, that "divine power is deliberately self-limited." This statement causes numerous red flags to popup in my mind. Indeed, in relation to the problem of evil, Polkinghorne spells out what voluntary self-limitation means: "God does not will the act of a murderer or the destructive force of an earthquake, but allows both to happen in a world in which divine power is deliberately self-limited to allow causal space for creatures" (Polkinghorne 2001b, 102). *Kenosis* understood as voluntarily divine self-limitation, therefore makes God culpable for failing to prevent evil. That's not at all desirable, for either Oord or I! For example, Oord (2010a, 176) claims the voluntary divine self-limitation view implies that love is *not* the primary aspect of God's nature. For him, further, the regularities we witness in our world are neither voluntarily inserted by God, nor do they transcend God from the outside. Rather, God's loving nature is the ultimate source of the natural world's law-like regularities. Therefore, the God who loves necessarily cannot interrupt the love divinely expressed to all.

However, while I somewhat appreciate the idea that God's "loving nature is the ultimate source" of the natural world's regularities (Oord 2010a, 178), I simply do not think that God's "love" constitutes regularities (by which I assume Oord is speaking of the laws of nature) in the world. Rather, as I see it, the imbibification of matter by the Spirit eons ago constitutes the presence and sustenance of the laws of nature. This is because, fundamentally, the Spirit is the "enacting arm" of the Trinity, insomuch as she imbibes within the world both contingency *and* regularity. Indeed, as I have earlier asserted, God (the executive, that is) himself delights in both

contingency and chance. I have claimed this, for in the natural world, both chance and contingency are "corralled," so speak, by the Spirit, in order to maximize the population of the world with diverse and beautifully different species. For the substance of this assertion, please see my discussion of Darwin's "principle of divergence" in chapter 2 of this dissertation. Further, while Oord notes his agreement with Polkinghorne when Polkinghorne states that "the regularities of the mechanical aspects of nature are to be understood theologically as signs of the faithfulness of the Creator" (Oord 2010c, 124–25), I again draw a contrast betwixt Tom and I. This is, simply, because of the everywhere evident "chancy" nature of the natural world. God is *not* "faithful" because he upholds the regularities of the world, but rather he *is* "faithful" when the very chanciness of the natural world is employed by the imbibified creative Spirit of contingency to evoke new, non-regularities within nature, instead. As I have aforementioned, if God is to be seen as solely a keeper-of-regularities, then (macro-)evolution would never proceed to any sort of novelty; it would, instead, remain in transient "perfection" forever.

At least, that is, until the next entirely devastating catastrophe is imposed by either extra-terrestrial events (i.e., asteroids, comets, meteors, *et cetera*), or some other calamity that might befall the earth. So then, when Oord (2017, 91) claims that essential kenosis adds to the keeper-of-regularities view, by asserting—essentially—that God's faithfulness derives from God's nature in which love is logically primary and necessarily expressed to the natural world, I simply find such to be unintelligible and nearly insensible. Polkinghorne (2005, 30) further states elsewhere that the regularities described by physics "are pale reflections of [God's] faithfulness towards his creation"; as a result, God "will not interfere in their operation in a fitful or capricious way, for that would be for the Eternally Reliable to turn himself into an occasional conjurer." While both Tom and I agree with Polkinghorne, at least here, the "essential kenosis"

view of Oord would say that because God's nature is kenotic love, God *cannot* interfere with these law-like regularities. In fact, Oord asserts that "Essential kenosis says key limitations to divine power derive from God's nature of love. The Creator does not voluntarily self-limit, nor does creation rule its Maker. Instead, God's self-giving, uncontrolling love is a necessary, eternal, and logically primary aspect of the divine nature. This logical priority qualifies how God works in and with creation" (Oord 2017, 91).

I would like to state, instead, that God has *no* omnipotent power to self-limit, whether that be conditioned by God's nature of love, or otherwise. Indeed, because God always *pours himself out* into whatever entity is in question—whether it be some "thing," or some "one"—God has not the "power" to do anything in and of himself. Instead, it takes the cooperation of species and other entities within the natural world—whether they be biotic or abiotic—for God to get his "intentioned" result (again I highlight that "intentions," though they may in some sense be difficult to describe fully, are virtually equivalent with God's *telos*; see chapter 5 of this dissertation). This *pouring out* of God through God's *kenosis* of the Spirit into the natural world, means, then—in some sense—that God is thereafter conditioned by the entities that ultimately derive from Godself, or at least God's response(s) are. This depiction of my own represents a full mutuality between God and his "world," as well as the entities that compose the natural world. Further, in his discussion of Clark Pinnock's (2001, 126) open theology, Oord notes that God created the world out of love and with the goal of acquiring a people who would, like a bride, freely participate in his love. Again, I raise the question: If God does all things in and through love, how might one distinguish between God's love and, say (1) a terrible tornado; (2) a violent hurricane; (3) some one person raping and thereafter mutilating the genitals of another person; or (4) even a half-brother forcing himself sexually on his younger sibling (for which I ask you to

reference McCall 2021b)? I also indefatigably claim that God created not much of *anything* “out of love,” besides maybe his Church. Of course, what I mean by this is that I deny that God “created” anything at all. Rather, through the imbibing of Spirit into the natural world, God invites all entities within it to cooperate with him in order to empower *them* to attain more complexity, diversity, and so on.

Oord includes the phrase “self-limitation” in his “essential kenosis” theology—although he immediately says that this limitation is “involuntary”—because it is based upon God’s love, in some sense. According to Oord, this phrase sets “essential kenosis” theology apart from the idea that something outside God imposes limitations. He notes that Polkinghorne rightly worries (in his opinion) that some theologies require “an external metaphysical constraint upon the power of deity” (Polkinghorne 2001b, 96). Oord’s “essential kenosis” theology agrees with Polkinghorne that one should offer a theology according to which “nothing imposes conditions on God from the outside” (Polkinghorne 2001b, 96). In fact, for Oord, God’s self-limitation in essential kenosis theology entails that any limitations in God exist by virtue of God’s own nature. That is, by what it means to be God. Oord goes onward to note that external forces and enforced obligations do not limit God. Rather, God is limited only by what it means to be God (Oord 2010b, 235).

In my own view of God’s *kenosis* of the Spirit into the natural world, however, God was, is, and will continue to be limited by factors *outside* of his control. What I mean by this is simply that God necessarily co-exists with an eternal world, which *ipso facto*, does constrain what God can possibly engender within said natural world. Indeed, what God can potentiate is thereby constrained by the formalist conditions of and within the natural world. This clarity regarding constraint emerges from the common emphasis—placed by all major structuralist critics—upon

the difference between positive and negative meanings of constraint. This parsing of positivity regarding constraint in (macro-)evolution proceeds by distinguishing two essential themes of: (1) speed or the enhancement of rates beyond the power of natural selection; and (2) channeling, or the preferential flow of change in particular directions set by internal possibilities (cf. Gould 2002, 1032). In short, the bipolarity of choice is between variation as raw material and natural selection as the shaper of change in Darwinism, versus channeled variation through natural selection for shaping by the impress of positive constraint(s). I have come to view the latter to be most parsimonious and fruitful option. Note the irony inherent in this assertion: i.e., this argument practically inverts the canonical roles of the two central components in Darwinian theory. Indeed, in Darwin's schemata, an internal source of variation provides the impetus in natural selection, whereas selection determines direction. Contrast this schemata with channeled change by constraint, wherein natural selection supplies the impetus by "getting the ball rolling," so to speak (see Galton's metaphor of the pool table, to be explained later, in chapter 7 of this dissertation), but the directionality of evolutionary change—or "where the ball rolls," so to speak—emerges from internal channels that use natural selection as their "convenient" source of power.

Furthermore, I will later assert (in chapter 7 of this dissertation) that Galton's polyvalent polyhedron is a metaphor and model that well-expresses the themes of formalist challenges to functionalist theories in the Darwinian tradition. Galton proposed his polyvalent polyhedron to explain a hierarchy of stabilities as internally generated, not externally shaped by gradual natural selection. This model of evolution by facet-flipping to limited possibilities of adjacent planes in ancestrally inherited structure, as related by Galton, stresses two themes: (1) channels set by internal constraint; and (2) evolutionary transition by discontinuous saltation. These two themes

are that which structuralist alternatives tend to embrace and that pure Darwinism must either: (1) address (which has not heretofore been done); or (2) simply dismiss (which has been done, most-often) as challenges to basic components of Darwinian natural selection's essential logic. This challenge to the Darwinian foundation is because the "channels" direct the pathways of evolutionary change from the inside, even though some external force—like natural selection—may be required as an initiating impulse. In an anticipative sense, I would like to proffer that the "polyvalent polyhedron" of Galton (to be more fully discussed in chapter 7 of this dissertation), embodies several major implications that assert and codify the power of formalist constraint as an important evolutionary agent of change (not just an impediment). First, internal factors for Galton establish a hierarchy of stabilities, discontinuous in origin, explaining thereby differing degrees of divergence among typical forms. Galton, then, proposed his polyvalent polyhedron to explain a hierarchy of stabilities as internally generated, not externally shaped by gradual natural selection. Second, I will note that for Galton, the positions of stability for discontinuities within species are not honed by natural selection, *per se*, but are internally preset as configurations of coherence among parts. As the third theme in Galton's polyhedronical model, his polyvalent polyhedron also highlights the theme of internally based directionality, not only of discontinuous change.

One can see that my conception of God's *kenosis* of the Spirit into the natural world through the imbibification of matter by the Spirit of God, is in fact distinctly different than Oord's "essential kenosis." Indeed, in that Oord's views hold that God's self-limitation entails that any limitations in God exist by virtue of God's own nature, whereas I assert that these "limitations" arise from that which is "other" than God. I would also like to point out that I differ with Oord further when he states that God "creates out of creation, because God's nature is love"

(Oord 2010b, 247). Oord refers to his conception of this postulation as "*creatio ex creatione a natura amoris*" (Oord 2010b, 247–48). He goes onward to note that because God's nature includes love for creatures, love for creation is God's motive and motion when creating. While I agree with Oord that *creatio ex nihilo* is problematic on several fronts, however, I disagree with him that we (late-)modern theologians of science should "reject theories of creation that imply God initially created our universe from pre-existing materials God did not create but 'happened upon' or 'found at hand'" (Oord 2010b, 248). Oord goes on, contending that we (late-)modern theologians "should deny that God creates from nothing, yet affirm that God initially created and continually creates in love from what God previously created" (Oord 2010b, 248). Regarding Oord's key elements of the doctrine that God creates out of creation through a nature of love (*creatio ex creatione a natura amoris*), he stipulates that the doctrine's essential components are comprised of at least the following (Oord 2010b, 251–52). Note that this sequence of affirmations by Oord has been broken up, and altered only slightly, by me.

1. God's eternal and essential nature of love motivates God's creating activity insomuch as "God's creating is always love in action;" which means, therefore that "it is [a] intentional response to promote overall-well being."
2. Moreover, God's creative activity "in the past and present brings into being something genuinely new," insomuch as God does not "merely rearrange what existed previously."
3. Third, God creates new things "out of what God created previously." So then, "matter never pre-exists God's creating," but God instead "creates from that which God previously created."
4. Fourth, to exist themselves, creatures necessarily "depend upon God's creative activity."
5. And fifth, creatures only "play a role in the coming to be of all things."

I would like now to register my deviations from Oord on the basis of the five selected points of his *creatio ex creatione a natura amoris* doctrine. Regarding the first point that I highlighted above, I would like to begin by noting that I disagree with Oord in his first statement, that is, that God "creates." Indeed, although I myself have used this terminology of "create/creating, etc." elsewhere with reference to God and his intermediaries—i.e., the Son and the Spirit (see chapter 7 of this dissertation)—I have, nevertheless, a burdensome problem with the notion that God "creates" anything—at all. Rather, in my most developed thinking, I assert that God is the most-polished-*shaper* (alike unto the Pinnock's "most moved mover") of the eternal natural world that co-exists with Godself. So then, while I at times promote the notion that God may "create," more often than not this is due to my preference of maintaining some sort of continuity with my established context. That is, working in (mostly) traditional Judeo-Christian-influenced churches and seminaries, and so forth. Notably, this situation of my own is alike unto how Darwin eventually consented to use "evolution" with reference to his own hypotheses, instead of the "real" meaning of *evolution*—that is "unfolding"—as well as instead of his using own preferred moniker for the same to be "descent with modification." Further, Darwin employed the term "adaptation," which was at the time strictly associated with Paleyan "natural theology," both of which are noted in chapter 2 above.

So then, I—on my best days—do not think that God "created" anything at all, but is (merely?) the craftsman of craftsmen, so to speak, with regard to eternally co-existent matter. Although, as I noted in both my "thesis and anticipated conclusions" section within my first chapter, God works with matter in order to make matter *matter*. This, then, leads directly to another disagreement between Oord and I. Indeed, Oord states in the above listing #2, that God's creative activity "in the past and present brings into being something genuinely new," insomuch

as God does not "merely rearrange what existed previously." I simply and strongly disagree with Oord on this notion. The "new" can only come from what previously existed, unless the first law of thermodynamics is entirely incorrect. Indeed, as well all know, this first law of thermodynamics indicates that the total energy of an isolated system remains constant through time. That is, it is conserved over all time-differentiations in the natural world. I will not pontificate upon this implication of thermodynamics beyond what is said here, for I must—my dear readers—leave something to write about in future.

In a related disagreement between Oord and I, I do not at all agree with his further statements—noted in the listing above as #3—that God creates new things "out of what God created previously," insomuch as "matter never pre-exists God's creating," but that God instead "creates from that which God previously created." Again, I highlight my assertion that God does not—in the truest sense of the term "create"—ever veritably "create" anything. Rather, matter in my view, indeed does co-exist with God. This stipulation that matter co-exists with God, in conjunction with my assertion that God does not "create" anything, *per se*, means that Oord's entire statement (#3 in above list)—that is, that God always "creates from that which he has previously created"—is uninterpretable by me, and in fact may border upon being nonsensical. So then, also Oord's fourth essential component of "essential kenosis" theology listed above—i.e., to exist themselves, creatures necessarily "depend upon God's creative activity"— is furthermore uninterpretable by me, if not downright nonsensical. This is a logical consequence of three points of disagreement between Oord and I that I have registered in the above paragraphs, note, so I will not revert to *ad hominem* argumentation of what I perceive to be a logical consequence of my above statements.

Moving onward to Oord's fifth essential component of his "essential kenosis" theology listed above, he writes that creatures (merely?) "play a role in the coming to be of all things." I assert, rather, due to my fully *kenotical* hypothesis of the full imbibification of the Spirit into the natural world, that "creatures" (or that which I would prefer to label as "entities") do not just play a "role" in the (macro-)evolution of all things—but instead—amplifying Hefner's statement in *The Human Factor* (1993) to the effect that we humans are "created co-creators," I contend God's entities are not *only* such. Rather, they are also what I would like to refer to as, "created co-determiners" with God through the intermediatory of the Spirit. This does not mean that everything that happens within the world is in accordance with God's "intentions," as I refer to them in chapter 1 of this dissertation. Instead, things do not always transpire according to divine plan. Building on this assertion, I would like to revert, once again, to Charles Sanders Peirce. As I pointed out in chapter 5, for Peirce, final causation without efficient causation is helpless, while efficient causation without final causation, however, is worse than helpless—with it being, instead, nothing but mere chaos. In what I referred to as an SDC model of causality in chapter 2, each instance of causation involves an efficient causal component, a final causal component, and a chance causal component (cf. Peirce 1998, 115). The efficient aspect of causation is nothing more than the contention that each event is produced by a previous event, the teleological aspect of causation simply states that each event is part of a chain of events with a clear tendency, whereas the chance component of causation is that each event of causation/causality has some aspect that is determined by neither the efficient nor the final cause, but instead by "chance" properly so-called. That is, it is marked by contingency.

Peirce therefore contends that spontaneity will not be overcome by some final end or *telos* (Hausman 1993, 17). As such, Peirce notes that the universe will always contain some

irregularity in it. That is, there will always be an expression of both freshness and brute fact in the universe. Indeed, for Peirce, there is always some "absolute chance" in the universe and therefore, "at any time… an element of pure chance survives" (for the full citation of this statement, see chapter 5). In Peirce's view, then, no matter what chance variation—and thereafter contingent processes within (macro-)evolution—produces, God can work it into his overall *telos*. For Peirce, indeed, no final cause is actual in that it could be arrived at through one set of means in one instance, but an entirely different set at another. Thus, "every final cause is a general type" (Short 1981, 369). Entities—whether animate or not—therefore attempt to "actualize in their own way the same general type or possibility actualized in the fullest possible way in God" (Short 1981, 371). What, then, is this general type or possibility that is actualized in the fullest possible way in God? I contend that the maximization of potentiality constitutes what is "actualized in the fullest possible way in God." So then, Oord's claim that creatures (or what I prefer to label, "entities") "play a role in the coming to be of all things," is somewhat modified by myself in advocating a fully Peircean lens with which to view all of reality. Thus and therefore, Oord's statement in chapter 6 of *The Nature of Love* that in his conceptioning—i.e., *creatio ex creatione a natura amoris*—"creating in love is essential to what it means to be God… [and, hence] God everlastingly creates" (Oord 2010b, 255) similarly is undercut by my assertions that God "creates" nothing, *per se*. God, in my view, instead molds, shapes, and artistically works with what has forever been alongside of himself—i.e., the co-existent, undifferentiated, and non-informationed matter of the co-existent natural world.

Before proceeding to the conclusion, please allow me to recapitulate the key points from this chapter that will enable me to substantiate both my introduction, as well as my conclusions to follow this chapter. Entities within the world could not love at all if our relational God were

not the lover who empowers, inspires, and beckons them to do so. Bluntly, love is inherently relational, meaning that love takes at least two entities, if not more. So then, what is most required in our depictions of love is a relational model of love, one through which we can speak meaningfully about the very complex relation between God and all entities that derive, ultimately, from God. Since God commands that we show "self-giving," "self-donating," and amorepotent love, we contemporary humans therefore indeed have the ability to love others as *kenotically*-donating entities, just as Godself does. In fact, if contemporary humans cannot truly and authentically love, we are of all creatures the most to be pitied. I closed this chapter with a proposal. Far from it being discouraged as "selfish," or even considered to be "need" love (a 'la Lewis), we contemporary humans should exalt *eros* love, because through it, we humans have attained our mastery over all other creatures. And in fact, we have unfolded (*evolutio*) into the status that we are in during this period of human history because of it. So then, instead of minimalizing *eros* love, I bring it to the forefront of the evolving processes on earth, and thereby bestow upon it a high value and importance not given to it by the majority of Christian history. My proposal is very simple: *eros* love is the means by which the advancement of species is educed, evoked, and effected.

Chapter 7: Conclusion—Constructing a Contingentist View of (Macro-)evolution in Dialogue with Amorepotent, Uncontrolling Love

Summary of Argument Heretofore

We are children of Darwin and an English school of adaptation and functionalism far older than evolutionary theory. Darwin remains our context. We may revere Isaac Newton as a man of equal impact, but (late-)modern physicists do not actively engage the ideas of its founder, as they pursue their daily work. Darwin, on the other hand, continues to "bestride our world like a colossus" (Gould 2002, 96). Darwin's key claim for the creativity of natural selection—and the resulting pathways of gradualism, adaptationism, and the isotropy of variation—builds the main line of defense for this powerful and venerable attitude towards nature and change. For many biologists, including myself (at times…), these claims lie too close to the core of our deeply assimilated and now largely unconscious beliefs to be challenged, or even overtly recognized as something potentially disputable. Yet a coherent alternative has been proposed, and now provides one of most trenchant contemporary critiques of strict Darwinism. I believe that these critiques, taken together, will (or should!) reorient evolutionary theory into a richer structure with a distinctly Darwinian core—at least in some point in the future. That is, it is akin to the Duomo of Milan, which—although the superstructure has been changed an innumerable amount of times over the centuries—has the "same" underlying structure. Important critiques can only operate against great orthodoxies.

I earlier referenced Gould's quote that Darwin "continues to bestride our world like a colossus." However, that is not to say that Darwinian theory need not be reformed, reformulated, and refined. In fact, I advocate—with Gould—some major restructuring of the basic core of Darwinian thought. This restructuring is an extension, not a replacement, of Darwin's overall vision. While the century before Darwin was in no wise ready to formulate such a concept due to

a multitude of cultural factors, perhaps it is now the time—in the century after Darwin—to in fact do so, with the knowledge gained by various battles won (and lost) over the previous century. May this century be permitted to (finally) reform Darwin's evolutionary theory(ies) beyond the unidirectional, single-level, and deterministic view of natural causality? That, my dear reader, is my hope.

***Kenosis*, the Spirit, and the Natural World**

Whether or not the natural world is eternal or not is certainly not a new question. Apparently as early as written language appeared, the idea of an eternal world was favored by pagan philosophers. Into this confusion, the Christian doctrine of *creatio ex nihilo* was formulated in the second-century C.E. to dispel such an idea and to affirm God's transcendence. The question of the origin of the world arises anew today in light of the current world view, marked by the scientific notion of (macro-)evolution, which has compelled new models of divine involvement to emerge. The resurgence of *kenotical* theology in this contemporary era, which includes many of my own writings, has been helpful in striving to reformulate divine involvement in an evolutionary world. The *kenotical* theology posited by this dissertation maintains that the Spirit, who *is* Love (see 1 John 4:16), completely shares and imparts herself *into* the natural world. God's *kenosis* of the Spirit led her to be "poured out" into the natural world, thereby causing it to leap forth from chaos and become a structured and orderly system of life-bearing entities in due time. Theologians as early as Ephraem the Syrian recognized that the derivation of the natural world was initiated through the Spirit. Indeed, Ephraem writes in his *Commentary on Genesis 1* that the Holy Spirit "warmed the waters with a kind of vital warmth, even bringing them to a boil through intense heat in order to make them fertile. The action of a hen is similar. It sits on its eggs, making them fertile through the warmth of incubation…Thus

we learn that all was brought to perfection and accomplished by the Trinity" (Assemani, 1737, 1:117).

As a result of this *Breath* of God imparted, nature gives birth to life, and *life-bearing* creatures burst upon the environ (see Ralston 2001, 58). So then, Ephraem sees the Spirit as the life-giving force that enables the natural world to strive toward becoming its fullness, via the processes of (macro-)evolution, I add. The creating Spirit freely limits her infinite power so as to allow for the existence of non-infinite entities (see Clayton 2005, 252). This dissertation affirms the notion that natural world was a result of God's *kenotical*-donation of the Spirit *into* it. Thus, this dissertation affirms the notion that the derivation of the natural world has its ontological origin in and through the agency of the Spirit of God. "Creation"—or what I would rather term the natural world— then, is a *kenotical* act of *self-offering*. Therefore, one may accurately posit that that natural world, in a *qualified* sense, possesses the Spirit of God from its very origin, though one needs to be wary of falling into a strict pantheism. Instead of reducing the natural world into a pantheistic entity, God is an all-embracing unity and the world exists "in" God in the sense that God is the ground of being for the created world (one can thus perceive the seed of panentheism).

Indeed, the Greek verb *kenoo* can mean either "to empty," or "to pour out." In the literal sense its Hebrew equivalent is used, for example, in Isaiah 32:15: "Until the spirit be *poured upon* us from on high.…" The Hebrew verb, in its original sense, refers to a cause of movement leading to a mass being poured out of a container (see Swanson 1997). Thus, the word also means "to pour out" in reference to Rebekah's pouring out the water from her pitcher *into* the trough for her animals (Gen 24:20, the verb in the LXX is *exekenōsen*). In the original Hebrew of

Gen 24:20, the term employed is a primitive root, meaning to *be* (i.e., causatively to *make*). Hence, it is appropriate to translate the term as either to *empty,* or to *pour out*. Note here that whereas the pitcher was emptied, the trough was made *full* (which is in a sense addition) by the emptying of the pitcher (see Wood 1996, 643). It is therefore concluded that a fruitful approach to understanding this difficult phrase is to realize that the verb *kenoo* also means "to pour out." I posit that the God's *kenosis* of the Spirit *into* the natural world had a similar effect as Rebekah's pouring of the water *into* the trough. Notably, there is an inherent other-centeredness in *kenosis*, as one can see in Rebekah's case, as well as Christ's *kenosis*, and—even!—Paul the apostle's *kenosis*. It may be extrapolated, further, that the same other-centeredness is present with the God's *kenosis* of the Spirit's *into* the natural world.

Indeed, the fleshly Christ poured himself *into* humanity so that it could be reconciled to the Father and that it might be acceptable to the Father (Phil 2:5–11), as the Father "intentioned." God, in the person of the Son, "enters into the limited, finite situation of man. Not only does he enter into it, *descend* into it, but he also accepts it and embraces the whole of human existence with his being" (Moltmann 1993; emphasis added). Paul the apostle similarly poured himself *into* the Church and its mission so that the reconciliation to the Father wrought by the Christ might be appropriated by the mass of men and women (see Phil 3:7–9; Gal 2:20, 3:28–29; 1 Cor 9:16), also as the Father had "intentioned" (Patitsas 1982, 77). The Spirit of God, moreover, *kenotically* empowered the incarnation, life and death of the Son of God (Bulgakov 2004, 257). Indeed, by the *kenotical* action of the Spirit into Jesus of Nazareth's baptism, the Christ was empowered for his subsequent ministry. Moreover, the *kenosis* of the Son of God on the cross offers an analogical understanding to God's *kenosis* of the Spirit into the natural world. That is,

the Son of God was *poured into* mankind, became man, and then returned to the Father; and then, by the *kenotical* action of the Spirit in the resurrection, Jesus of Nazareth additionally debilitated the damning effects of sin. Moreover, in the transfiguration, the *kenotical* action of the Spirit revealed a portion of the glory of God the Father through God the Son (Bulgakov 2004, 346). I could go on, but I think I have established my point: in reality, all of the works of the Christ from God were actualized by the *kenotical* action of the Spirit (the Christ is the *anointed* one, note). One may properly adduce that the Father sends the Son into the material world *through* the agency of the Spirit, who later gets sent into the world *through* the agency of the Son (Bulgakov 2004, 263). So then, *kenosis* is the general way in which God interacts with the world.

It is interesting to ponder that the term *kenosis* is most frequently linked to Christ's voluntary renunciation (i.e., "self-emptying") of certain divine attributes in order to identify himself with mankind, as recorded in the Pauline hymn found in Phil 2:5–11. However, the *kenosis* of the Son of God referred to in the Phil 2:5–11 passage *cannot* be understood to mean a *subtraction* of divinity, but the *addition* of humanity instead. Indeed, in the passage of Phil 2:5–11 itself, the verb often translated as "emptied" is explained, expanded, and extrapolated by three participles that directly follow it—(1) *taking* the form of a servant, (2) *becoming* in the likeness of men, and (3) *being found* in fashion as a man. Clearly, even in this reference to Christological *kenosis*, the net effect is addition, and not the subtraction of deity that those who interpret it as a "self-emptying" claim that it is. Furthermore, the Philippians usage of the term *kenosis* eerily resembles that which is found in Isaiah 53:12, which reads that "he *poured out* his soul to death." I posit that this meaning of *kenosis*, that is, "poured out", is best indicative to God's *kenosis* of the Spirit *into* the natural world. God's *kenosis* of the Spirit can also be seen, for example, in her descent upon Jesus at his baptism. Indeed, the Spirit was *poured into* Jesus of Nazareth so as to

empower Jesus for his crucial ministry of imparting life to the masses, which resulted in Jesus' own temporal and bodily death. So then, the principle that one may draw from the usage of *kenosis* in reference to God the Son is illustrative of the *kenosis* in reference to God the Spirit regarding the divine essence.

God's *kenosis* of the Spirit into the natural world moreover directly entails the notion that creatures owe their existence to the Spirit's creative energies imparted into it (and them). So then, the Spirit's most potent role—being *poured into* others and other "stuff"—makes possible both the life and the activity of the other (Linahan 2005, 181). The entire mission of the Spirit could be succinctly envisioned as one of *kenosis* (Richard 1997, 116). By extrapolation, one may infer that the Spirit was *poured into* the natural world so that it might develop fully in complexity, relationality, and beauty in varied and multifarious forms, along with the extension of diversity and its concomitant increases of multiplicity. Notably, the verb used in the Genesis myth of creation (1:2) depicts the presence of the Spirit of God hovering mysteriously over the waters, preparing for the activity to follow. It is interesting to also note that the Hebrew verb has been translated "hovering" (as a bird over her young, see Deut 32:11), whereas the cognate Syriac term means "to brood over; to incubate." That the Spirit of God was hovering like a mother stork might hover over her nest is a portent of life to come from the dark, murky depths of the chaos below.[1] So then, the Spirit, one may postulate, is ultimately responsible for both the conditions for life, as well as life itself. Indeed, the Spirit is the "enacting arm" (or effectual arm) of the Father in that she was active as the Father spoke each word in the primal creating moments *hagiographically* recorded in Gen 1 (please understand that by using this term here, I merely mean to highlight that the bible was a composition written in reflection to and on God's dealing

[1] Note that the Spirit is described as a *dove* in Matt 3:16.

with the particular nation of Israel, and hence cannot be used as a modern "scientific" textbook.). Note also that the Spirit, or breath of God, is likewise presupposed in the creation accounts of gospel of John, chapter 1 that depict the Son's agency.

What God does particularly and singularly in the *kenosis* of Jesus of Nazareth (the Son) into human form, I posit, God does generally and continually through the *kenosis* of the Spirit into the natural world. The Spirit is the *breath of life*, the very giver of life, and is thus the creative power of the Father (Edwards 2004). The Spirit, then, is the vital energy that enlivens, as well as the potent force that makes practical God's gratuitous acts toward the natural world (for this point, please see the various titles of Sergius Bulgakov, including Bulgakov 1993, 113; Bulgakov 2002, 431; Bulgakov 2004, 347; and Bulgakov 2012, 200). Notably, Bulgakov states that the Holy Spirit "descended to make humanity Christ's, *to actualize the salvation of the world*, brought by the Savior" (Bulgakov 2004, 349; emphasis in the original). While it is not my intention to pontificate on the entirety of trinitarian doctrine, I will note that my own position is highly influenced by the Eastern Orthodox position on the Trinity. As we all know, in the West, the Trinity is viewed to be three equal persons or modalities. However, in the Eastern tradition, the Trinity is pictured markedly different: the "Father" (God) is proverbially on top of the other two "legs" of the Trinity, that is, the Son and the Spirit, as a sort of "executive" (Bulgakov 1988, 183–84). So, then, in the Eastern tradition, it seems to me, God is still the corporate "head," even though he may not be the one to do all things, or even perhaps anything at all for that matter.

In this sense, then, God is an "executive," who delegates his power and authority to the Son and Spirit. We can see examples of this "executive" leadership throughout our current society, which gives a model with which to picture divine involvement. Indeed, for example, the "President" of any nation rarely does anything him or herself. However, by his decrees, or

executive actions, he instructs and enables other people to actually do the work. Also, a CEO of a Fortune 500 company may make the very important decisions regarding his or her company, but generally has a "hands-off" approach to most day-to-day activities. So then, while the subordinates may indeed do the activities, when things go wrong, for example, the fault does not fall on them, but on the executive of the company instead. This is the imagery I wish to connote by employing the term "God" throughout this dissertation. So then, God's activity regarding the *kenosis* of the Spirit—the *pouring out* of life—makes possible not only otherness as properly conceived, but also its actualization.

Kenosis is certainly not a picture of a traditional monological act of derivation by direct production. Instead, by deriving the natural world and other "stuff" (which includes hominins and other entities) in a *kenotical* manner, God both allows and invites the input of entities, and reacts according to that input. In fact, this is the sum of amorepotent love: God invites full reciprocity between himself and the *other*, that is, the natural world. Thus, God has chosen to allow the *other* to act, and has chosen to invite the natural world into a cooperative relationship. So then, God works with what has already been derived in order to develop the natural world still further. This, then, is full mutuality between God and the entities that derive ultimately from Godself, and that shall return to Godself. Indeed, God is an agent, but only an agent that works cooperatively with what already exists, such that there could be no agency of God without a world in co-existence. God's inherent nature as amorepotent love means, though, that God does not ever shutdown the agency of the natural world itself. Not-even-once! On the contrary, the nature of God's agency—based on *kenotically*-donated and amorepotent love—ensures the enabling and strengthening of agency for every "created" being, be it animate or not. Indeed, going back to my allusion to botany in chapter one, when we say that the seed imbibes

the water from the ground, the seed should be pictured as a finite agent. So then, in this analogy, it is both true that the seed is the receptor (a sort of agent), and the water is an agent. However, ut at the same time, the seed must actively imbibe the water from its surrounding environment. It is a both/and type of scenario, insomuch as it is a co-constituting and a fully reciprocal process between two individual agents.

The *kenotical* creating Spirit does not overrule her "creation" or its creatures, but continuously *interacts* with them instead (note that I am using this term "creation" in this sentence, not as a doctrine, but as resembling how an artist may refer to a painting that has been "worked on" for countless hours, over countless days, as her "creation"). Such an understanding is basic to the interpretation of (macro-)evolutionary history as the natural world making itself. So then, the "creative" actions of the Spirit are an activity of divine *kenosis*, an expression exercised by *eros* love, through which God allows entities to be themselves. Moreover, in order to be consistent within the causal nexus, the Spirit of God *kenotically* bestows causal power to the derived order, and in effect thereafter becomes the chief influencer amongst influencers (Polkinghorne 2001b, 104). So then, God's *kenosis* of the Spirit into the natural world *kenotically* bestows both potentiality and "being" ("Let there be…"). Further, as Michael Lodahl notes, the "Spirit of God is identified as the possibility of God" (Lodahl 2004, 4). Moreover, hiddenness is the basis of *kenosis*, contends Ernest Simmons. Simmons (1994, 14) also notes that the Hebrew *ruach*, as well as the Greek *pneuma*, both carry with them a sense of hidden and unseen forces. Thus, the natural world is, in a sense, *larva dei*, the mask of God. Being panentheistic in relation, there is both distinction and relatedness between the Spirit and the natural world. Because the Spirit and the natural world are intrinsically joined together, there is no need of a "causal joint," *per se*, for they are composed of the same potentiality. This previous

postulation—that is, the non-need of a causal joint—may turn out to be the most important assertion that one can take from this dissertation. Time will tell.

Therefore, the properties of the propensities within the evolutionary epic (or play) can be regarded as a feature that has been endowed by God's *kenosis* of the Spirit. Moreover, the Spirit—far from being "daunted" by chance—actually employs chance in a cooperative fashion in the derivation(s) of God's intentions in the natural world. So then, the way in which chance—or contingency—operates within the world to produce new structures, new entities, and even new species, can properly be understood as an actualization of the potentialities with which the enervating Spirit imbibed the natural world. Thus, the erotic Spirit's intention and purpose are actualized through the operation of "chance" and "random" events in cooperation with the natural world. One can thereby perceive God everywhere within (macro-)evolution. Indeed, the processes themselves—as unveiled by the biological sciences—are God-acting-as-creator.

Notably, emphasis on divine love lies behind process theology's picture of a God who, in Alfred North Whitehead's (1979, 351) moving phrase, is a "fellow-sufferer who understands," and who involves himself only through the power of persuasion. Whitehead held that God and the world have always coexisted, and that God "creates" by working with what already exists. An eternal presence of the natural world, for Whitehead, rests on God's inherently relational nature. In sympathy with Whitehead's assertion that God only "acts" through persuasion, the *kenotical* view of the derivation of the natural world through *eros* love, that which I advocate herein, posits that God's involvement is constituted by God *luring* creation, and all of its entities, toward his pre-established goals (or "intentions"), which is nothing other than greater complexity, beauty, relationality, diversity of entities, and ultimately greater manifestations of sentience. I also posit that there is a definitive *lure* of the Spirit within the propensities of nature.

So then, it is at least conceivable that the *kenotical* impartation of the Spirit into the natural world by God effects or causes these “propensities” in nature to be worked-out cooperatively with the entities that ultimately derive from God. Moreover, the Spirit of God did not need to “create” in a single, direct act, but instead uses a (macro-)evolutionary process in which the natural world was allowed to develop at its own pace. Instead of creating a finished product by divine fiat, the Spirit allows the world to develop cooperatively within the framework that God initially set up.

This notion of creation through development also leads to an understanding of biological evolution in which the Spirit is seen as using the cooperative development of entities as a type of *continuing* creation. There exists overwhelming evidence of a universe marked by development, which points to derivation by *kenosis*. The *kenotical* Spirit is present within the historical contingency of evolution, as well as its lawful regularity (Polkinghorne 2001b, 96). Thus, the Spirit involves herself cooperatively within the causal nexus of natural world. So then, the Spirit did not bring about the natural world in a *single*, definitive action, but instead cooperatively employed the processes of (macro-)evolution guided by imbibed natural laws (or what Peirce would call “habits”). Indeed, that which is the fullness of God (i.e., the Spirit) enters into “unfullness” so that the “unfullness” may later be made full. Thus, the overall purpose of God’s *kenosis* of the Spirit into the natural world is *theosis* by means of *enosis* (Ellis 2001, 109). That is, the purpose of *kenosis* is *theosis*, or union with God, by means of *enosis*, or the infilling by God. This idea supports the notion of Thomas Aquinas, aforementioned, who indicated that resemblance to God is the ultimate end of all things. Overwhelmingly I conclude that the Spirit was, as it were, “taking a risk” in cooperatively creating a world *kenotically*, for it necessarily involves both chance and randomness through the processes of (macro-)evolution (cf. Peacocke

2001, 27; for further elaboration of this idea, see McCall forthcoming-c). This last invocation segues well into a discussion of Gould (again).

Gould's Paradoxical Proposal Presented

Indeed, moving back to Gould, in his paradoxical epilogue to *TSoET*, Gould argues (despite his predominant role as a champion for the importance and scientific respectability of unpredictable contingency in the explanation of historical patterns) that the enlargement and reformulation of Darwinism, as proposed in *TSoET*, will recapture for general evolutionary theory—by adding a distinctive and irreducible set of (macro-)evolutionary causes to the armamentarium of evolutionary principles—a large part of (macro-)evolutionary pattern that Darwin himself, as an *equally* firm supporter of contingency, willingly granted to the realm of historical unpredictability because he could not encompass these results within his own limited causal structure of strict reliance upon smooth extrapolation from (micro-)evolutionary processes by accumulation through the immensity of geological time, himself constrained as it were by using his mentor's uniformitarianism (i.e., Lyell). While a plethora of fossils have been discovered in the ~150-some-odd years since Darwin's death, nevertheless, fewer examples of gradual change within forms of life have been found than might have been expected. Until rather recently, indeed, the discrepancy between the model of slow phyletic change and the poor documentation of such change in much of the fossil record has been ascribed to the imperfection of the fossil record itself. The "one long argument" (cf. Darwin's own statements to the same effect) of Gould's *TSoET* holds that a synthesis, though still very much in progress, has now sufficiently coagulated to designate the best current understanding of the structure of evolutionary theory as something rich and new, with a firmly retained Darwinian core—in other

words, it is a validation of Falconer's, rather than Darwin's, concept of historical growth and change: i.e., it is akin to the Duomo of Milan.

So then, nothing of Darwin's central logic has faded or fully capsized, but his theory has been transformed into something far different, far richer, and far more adequate to guide the understanding of nature. After all, the rationale for *TSoET* depends, in large part, on Gould's notion of a Darwinian essence being construed as a "minimal" but "distinctive" set of interpenetrating concepts: the Darwinian set of ideas implies a basic intrigue with: (1) functional and adaptational arguments; it also includes (2) preferences for gradualism of change; (3) a genuine separability of parts; and (4) the efficiency of competition. An opposing set—an aggregation that exerted a far lesser, but still identifiable, pull upon Darwin himself, and that motivates the formalist "nucleating center" of Gould's (2002, 397) central argument in *TSoET*, includes (1) fascination with "structurally" based correlation; (2) fascination with evolution by "internally" generated sources of variation; and (3) suspicion of adaptational "just-so stories" as primary explanations for basic organic features. This contingentist story, of course, continues for each lineage of this grandeur of life, with a constant twinning of contingency and structural potentiality. Again, I reiterate: if one marginal group of lobed-fin fishes had not evolved a peculiar and particular fin, with a branching central element orthogonal to its body's antero-posterior axis (rather than parallel to the axis, as in most members of the clade), no support firm enough to build the centerpiece of a terrestrial limb might ever have emerged within the lineage of vertebrates. Furthermore, if these resulting tetrapod's had never evolved their forelimb for terrestrial locomotion, the celebrated convergence of aerodynamic form in the wings of bats, birds and pterosaurs—the supposed disproof of contingency's dominant role in evolution!—would have died for want of a common substrate on which to hang these adaptive marvels of

excellency. These types of occurrences form the basis of the contingentist story, which I have outlined in previous chapters.

As recounted above in chapter one, in the late 1960s, two young scientists—Niles Eldredge and Stephen Jay Gould—ventured the radical proposal that perhaps the fossil record is not so imperfect after all. Both Eldredge and Gould had backgrounds in geology and invertebrate paleontology, and both were impressed with the fact that there was very little evidence of phyletic change in the fossil species they studied. Typically, a species would appear abruptly in the fossil strata, last 5–10 million years, and disappear not much different than when it first appeared. Another species, related but distinctly different—and "fully formed"—would take its place, persist with little change over 5–10 million years, and then disappear equally abruptly. Suppose, Eldredge and Gould argued, that these long periods of no change ("stasis") punctuated by gaps are not flaws in the fossil record but *are* the record, the evidence of what really happened. How could it be that a new species would make such a sudden appearance? Eldredge and Gould found their answer in a modified allopatric speciation model: if new species formed principally in small populations on the geographic periphery of the range of the clades, if speciation occurred rather rapidly (in thousands rather than millions of years), and if the new species then out-competed the old one(s), taking over the geographic range, the resulting fossil pattern would be the one we actually observe today: that is, a generally "punctuated" one.

Will the punctuated equilibrium model be assimilated into the modern synthetic theory? Or will some radical new concept of evolutionary mechanisms spread through the scientific strata, out competing the old ideas? At this writing, in 2021 C.E., it is too early to tell—all that is clear is that this punctuated equilibrium model has stimulated a vigorous debate, a reexamination of evolutionary mechanisms as currently understood, and a reappraisal of the evidence. All of

this indicates that evolutionary biology is alive and well in the (late-)modern environ, and that scientists are doing what they are supposed to be doing—asking questions. Darwin, I think, would have been delighted and well-pleased. But what if adaptation does not always record the primacy of natural selection, and the adaptation arises secondarily? What if, for example, variation itself imposes strong constraints and supplies powerful channels of preferred direction for change? What if the nature of variation often produces change without insensible intermediacy? These arguments merge to form a structuralist critique that seriously challenges the predominant functionalism of classical Darwinism. As a common thread, these challenges deny exclusivity to natural selection as the agent of "creativity," but not the fruitful operation of natural selection as such, and also claim a high relative frequency of control by "internal" factors.

While Darwinian functionalists have tended to admit certain kinds of "constraints," they have then tried to "limit" their modes of occurrence and domains of action in such a manner that the central principle of Darwinian theory—the control of evolutionary change by natural selection—will not be authentically threatened. Indeed, orthodox Darwinians have not recoiled at negative constructions of constraint as "limits" and "impediments" to the power of natural selection in certain definable situations. However, they are far less willing to embrace "positive" meanings of constraint as promoters, suppliers, and causes of evolutionary change (see Gould 2002, 1028). This distinction between "negative" and "positive" constraint follows logically from the basic premises of Darwinian functionalism. This is because the admission of a potent and positive version of constraint would compromise the fundamental principle that the structuralist and internalist component of evolution—that is variation itself—only *proposes*, while functionalist and externalist selection *disposes* as the only effective cause of change.

Francis Galton's Polyvalent and Polyicitous Polyhedron Propounded

Before closing this dissertation, I would like to discuss a (late-)nineteenth-century "formulation," "depiction," or perhaps better: "model," that I have a great deal of consonance with intellectually in this (late-)modern environment. It comes from Francis Galton's polyvalent and polyicitous[2] polyhedron, which amounts to what could be termed "non-Darwinian moves." The history of debate about Darwinian theory has brought the theme of positive constraints into sharp focus in the twenty-first century. This clarity regarding constraint emerges from the common emphasis placed by all major structuralist critics upon the difference between positive and negative meanings of constraint, and the parsing of positivity into two essential themes of speed (or enhancement of rates beyond the power of natural selection) and channeling (or the preferential flow of change in particular directions set by internal possibilities) (see Gould 2002, 1032). Note the irony in this assertion: this argument practically inverts the canonical roles of the two central components in Darwinian theory: indeed, an internal source of variation provides the impetus in natural selection, whereas selection determines direction. Contrast this with channeled change by constraint, wherein natural selection supplies the impetus by "getting the ball rolling" (to use Galton's metaphor of the pool table, to be explained later), but the directionality of evolutionary change—or "where the ball rolls"—emerges from internal channels that use natural selection as their convenient source of power. In short, the bipolarity of choice is between variation as raw material and selection as the shaper of change in Darwinism, versus selection as raw power, and channeled variation for shaping by theories of positive constraint.

Galton's polyicitous polyhedron is a metaphor and model devised by Darwin's eccentric cousin, Francis Galton, which clearly expresses the two great and historically conjoined themes

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[2] I have coined this term, "polyicitous," to mean essentially the same the same thing as does the English term "multiplicitous," but with the intention that it refers, like polyvalent, to five or more mental "things."

of formalist (or structuralist, or internalist, in other terminologies) challenges to functionalist (or adaptationist, or externalist) theories in the Darwinian tradition. Since Darwin's essential trio of assumptions about variability—copious, small, and undirected—permit only natural selection to act as the creative force of change, non-Darwinian alternatives, by logical necessity, deny one or more of these assertions. The diverse formalist theories after the *Origin* (Darwin, 1859) gain conceptual unity in granting directional power to internal factors, and not only to the interaction of environment with isotropic raw material. Formalist alternatives to these Darwinian bastions grant directional power to internal causes (whereas a denial of the third claim of copiousness only places limits upon natural selection without supplying any substitute as a cause of change).[3] Indeed, the most striking model and epitome for this formalist opposition derives from a source that will strike many evolutionists as paradoxical—Darwin's brilliant cousin, Francis Galton. These two men shared Erasmus Darwin as a grandfather, note. Galton, a pluralist in his views on evolutionary causality, viewed discontinuous variation as more efficacious than simplistic gradualism. Galton wrote that evolutionary theory "might dispense with a restriction for which it is difficult to see either the need or the justification, namely, that the course of evolution always proceeds by steps that are severally minute, and that become effective only through accumulation. That the steps may be small and that they must be small are very different views; it is only to the latter that I object" (Galton 1889, 32).

Galton proposed his polyvalent and polyicitous polyhedron to explain a hierarchy of stabilities as internally generated, not externally shaped by gradual natural selection. This model of evolution by facet-flipping (as the polyhedron will allow) to limited possibilities of adjacent

[3] Thus, in this late 19th century heyday of alternatives to Darwinism, formalist and structuralist thought centered upon claims for the evolutionary importance of saltational and directional variation. After all, if the creative force of evolution resides in the process of somewhat directed variation itself, then the nature of internal channeling assumes crucial importance (see Gould 2002, 361).

planes in inherited structure, stresses the two themes—(1) channels set by internal constraint, and (2) evolutionary transition by discontinuous saltation—that structuralist alternatives tend to embrace and that pure Darwinism must combat as challenges to basic components of its essential logic. This necessary combat on a pure Darwinian foundation is because the "channels" direct the pathways of evolutionary change from the inside, albeit in potentially positive and adaptive ways. However, some external force—like natural selection—nevertheless may be required as an initiating impulse. Contrast this saltational change with the Darwinian requirement for selection's creativity, and one will immediately discern that it "violates" Darwin's tenets for selection's creativity by vesting the scope and direction of change in the nature and magnitude of internal jumps—and not in sequences of adaptive accumulations mediated by natural selection at each step. Thus, punctuational events (rapid transition between domains, based on structural properties of endpoints that actively resist change) are truly different than purely saltational events—i.e., a veritable sudden transition, due to the inaccessibility of intermediary states.

In emphasizing "sports" for evolutionarily efficacious variation, and stability for taxa at other times (as regression to the mean holds continuous variants in check), Galton also became a hero of the early Mendelians,[4] particularly for his role in formulating a general rationale for their non-Darwinian concept of saltational origin for new species by macro-mutation. Galton's polyhedron subsumed both non-Darwinian formalist themes of discontinuity in effective variation and internally-generated, preferred channels of change (constraints), into a brilliant metaphor. This polyhedronical image has been forgotten by most twentieth (-plus) century

[4] Note that "early" Mendelians were decidedly non-Darwinian in their flavor. Ironically, the first application of Mendelism to evolutionary theory did not help to affirm Darwinism, but to assert the saltatory origin of new species by macromutation instead; indeed, the original construction of "mutation theory" was ardently anti-Darwinian. The Modern Synthesis, the fusion of Darwin and Mendel, began about two decades later when scientists finally realized that small-scale (Darwinian) variation could also claim a particulate basis, and that macromutations played little to no important role in evolution.

biologists, but many of Galton's contemporaries discussed the model and its implications. For example, St. Georges Mivart (1871, 97) invoked the polyhedron as a centerpiece of the critique that most attracted Darwin's attention and response. Notably, William Bateson (1894, 42) described "the metaphor which Galton has used so well—and which may prove hereafter to be more than a metaphor."[5] Kellogg, speaking of Galton's "familiar analogy" (Kellogg 1907, 332), considered the polyhedron as an ideal illustration for the non-Darwinian challenge of heterogenesis (saltational evolution). And Hugo de Vries (1909, 1:53), in his *The Mutation Theory*, stated that Galton's polyhedron expressed his own view of variation "in a very beautiful way."

Galton introduced the metaphor of the polyhedron in (probably) his most influential book, *Hereditary Genius* (1869). Galton therein writes, in discussing "stability of types":

The mechanical conception would be that of a rough stone, having, in consequence of its roughness, a vast number of natural facets, on any one of which it might rest in "stable" equilibrium. That is to say, when pushed it would somewhat yield, when pushed much harder it would again yield, but in a less degree; in either case, on the pressure being withdrawn, it would fall back into its first position. But, if by a powerful effort the stone is compelled to overpass the limits of the facet on which it has hitherto found rest, it will tumble over into a new position of stability, whence just the same proceedings must be gone through as before, before it can be dislodged and rolled another step onwards. The various positions of stable equilibrium may be looked upon as so many typical attitudes of the stone, the type being more durable as the limits of its stability are wider. We also see clearly that there is no violation of the law of continuity in

[5] Notable also is that Bateson invented the word "genetics" in 1905 C.E., after the (re-)discovery of Mendelism in or about 1900 C.E., which brought with it, in full fruition, the alleviation of all impediments to the theretofore non-understood mechanism of heredity.

the movements of the stone, though it can only repose in certain widely separated places (Galton 1869, 369).

About twenty years later from his first title, in *Natural Inheritance*, Galton's metaphor moved from an afterthought in the back of the book to the focal argument of an early chapter on "organic stability." Galton therein granted his polyhedronical image an abstract and formal geometry. Galton writes:

> It is a polygonal slab that can be made to stand on any one of its edges when set upon a level table… The model and the organic structure have the cardinal fact in common, that if either is disturbed without transgressing the range of its stability, it will tend to re-establish itself, but if the range is overpassed it will topple over into a new position… Though a long established race habitually breeds true to its kind, subject to small unstable deviations, yet every now and then the offspring of these deviations do not tend to revert, but possess some small stability of their own. They therefore have the character of sub-types, always, however, with a reserved tendency under strained conditions, to revert to the earlier type. The model further illustrates the fact that sometimes a sport may occur of such marked peculiarity and stability as to rank as a new type, capable of becoming the origin of a new race with very little assistance on the part of natural selection… When the slab rests… on the edge AB… it stands in its most stable position… So long as it is merely tilted it will fall back on being left alone, and its position when merely tilted corresponds to a simple deviation. But when it is pushed with sufficient force, it will tumble on to the next edge, BC, into a new position of stability. It will rest there, but less securely than in its first position; moreover its range of stability will no longer be disposed symmetrically. A comparatively slight push from the front will suffice to make

> it tumble back, a comparatively heavy push from behind is needed to make it tumble forward… If, however, the slab is at length brought to rest on the edge CD… the next onward push, which may be very slight, will suffice to topple it over into an entirely new system of stability; in other words, a "sport" comes suddenly into existence (Galton 1889, 18–34)

In a later article on "Discontinuity in Evolution," Galton strongly asserts that most evolutionary novelty, in opposition to Darwin, probably arises *per saltum*: "Many, if not most breeds, have had their origin in sports" (Galton 1894: 365). Galton bases his rationale on the argument that continuous, small-scale Darwinian variability—though omnipresent—cannot be effective because regression toward the mean precludes accumulation in favored directions. Galton introduces the term "transilience" (literally "going between") to describe his favored concept of non-Darwinian saltatory variation, or facet flipping:

> No variation can establish itself unless it be of the character of a sport, that is, by a leap from one position of organic stability to another, or as we may phrase it, through "transilient" variation. If there be no such leap the variation is, so to speak, a mere blend or divergence from the parent form, towards which the offspring in the next generation will tend to regress; it may therefore be called a "divergent" variation… I am unable to conceive the possibility of evolutionary progress except by transiliences, for, if they were merely divergences, each subsequent generation would tend to regress backwards towards the typical center (Galton 1894, 368).

Galton also writes the following: "By what steps did A change into B? Was it necessarily through the accumulation of a long succession of alterations, individually so small as to be almost imperceptible, though large and conspicuous in the aggregate, or could there ever have

been abrupt changes?" (Galton 1894, 363). Acknowledging the criterion of relative frequency for resolving debates in natural history, Galton (correctly in my opinion) notes that Darwin did catalog exceptions, but only to stipulate their peripheral character and to assert the domination of gradualistic accretion by natural selection leading to adaptation:

> Notwithstanding a multitude of striking cases of the above description collected by Darwin, the most marked impression left on the mind by the sum of all his investigations was the paramount effect of the accumulation of a succession of petty differences through the influence of natural selection. This is certainly the prevalent idea among his successors at the present day, with the corollary that the Evolution of races and species has always been an enormously protracted process. I have myself written many times during the last few years in an opposite sense to this (Galton 1894, 363).

In summary of the contentions regarding the "polyicitous polyhedron" of Galton, I stipulate that the polyhedron embodies (at least) four major implications that assert and codify the power of formalist constraint as an important evolutionary agent of change (not just an impediment), while controverting the essential Darwinian claim that natural selection alone builds new forms in a creative and (especially) accumulative fashion. First, occasional large variations (sports) are more important for evolution than omnipresent, normally distributed small variation. This substitution of big for small forces a major compromise, and perhaps even represents a fatal weakness, in Darwin's theory of natural selection. Galton did not deny continuity entirely, but he wished to substitute a series of jumps for Darwin's smoothness. Indeed, Galton writes:

> It is shown by Mr. Darwin, in his great theory of "The Origin of Species," that all forms of organic life are in some sense convertible into one another, for all have, according to

> his views, sprung from common ancestry…. Yet the changes are not by insensible gradations; there are many, but not an infinite number of intermediate links; how is the law of continuity to be satisfied by a series of changes in jerks? (Galton 1894, 369).

Second, for Galton, internal factors establish a hierarchy of stabilities, discontinuous in origin, and explaining differing degrees of divergence among typical forms. Galton proposed his polyicitous polyhedron to explain a hierarchy of stabilities as internally generated, not externally shaped by gradual natural selection. Galton presumably purposely shaped his model to encompass both small islands of stability within species ("subtypes" in his terms), and also to cover the origin of completely "new" taxa that cannot revert across different facets of the polyicitous polyhedron. Third, for Galton, the positions of stability, for both subtypes (discontinuities within species) and types, are not honed by natural selection, but internally preset as rare configurations of coherence among parts; the causal basis of stable form must therefore be explained by internal integrity, not only by adaptation. To illustrate this point, Galton proposed an internal basis for morphological stability:

> It is easy to form a general idea of the conditions of stable equilibrium in the organic world where one element is so correlated with another that there must be an enormous number of unstable combinations for each that is capable of maintaining itself unchanged, generation after generation (Galton 1894: 370).

As the fourth theme in Galton's polyhedronical model, the polyicitous polyhedron also highlights the theme of internally based directionality, not only of discontinuous change. Merely a status as provider of an impetus for change scarcely fulfills Darwinian requirements for selection's power, which I have noted above extensively. In a metaphor for illustrating pure Darwinism, organisms may be represented as billiard balls, with natural selection as the pool

cue. A perfectly round ball denotes Darwinian isotropic variation; the organism only supplies raw material, and cannot set its own direction of change. The billiard ball's trajectory depends upon the pool cue of natural selection and the form of the surface (local environment). The pool cue supplies propulsion, and the ball rolls with no internal control over its own direction of motion. But Galton's polyicitous polyhedronical model also pushes back. Indeed, what about miscues?

Absent an impetus, the polyicitous polyhedron cannot tumble at all, but the pusher doesn't set the direction of motion. The direction of tumbling, instead, is determined as much by the internal structure of the polyicitous polyhedron as by the strength of the impetus. Only certain, internally established channels of change can be realized, even if natural selection always initiates the tumbling of the polyicitous polyhedron. In this sense, Galton's polyicitous polyhedron weds the theme of directionality with the idea of discontinuity. So then, in terms of Galton's polyicitous polyhedron, the proverbial pool cue stick of natural selection may always do the actual pushing, but if internal channels—set by history, and thereafter grafted into the genetic and developmental architecture of current organisms—designate a limited set of possible pathways as conduits for selection's pushing, then these internal constraints can assuredly claim equal weight with natural selection in a full account of the causes of any particular evolutionary change.

Galton concludes the treatment of his polyhedronical formulation in "Discontinuity in Evolution" with a formalist flourish: "I therefore insisted that the continual appearance of these well-marked and very distinct patterns proved the reality of the alleged positions of organic stability, and that the latter were competent to mold races without any help whatever from the process of selection, whether natural or sexual" (Galton 1894, 366). In his *Hereditary Genius*

(1869), Galton highlights the polyicitous polyhedron's theme of internally based directionality (channeling of constraint), not only of discontinuous change; Galton states that his model did not deny continuity in change (Galton 1869, 369), but only confuted the insensibly gradual character of transitions—for the polyicitous polyhedron tumbles in a jerky fashion by facet-flipping, and does not roll smoothly towards "better" positions. Galton's conception of change, however, does grant a role to natural selection, as some force has to push the polyicitous polyhedron, which apparently natural selection provides.[6]

Formalism indeed boasts a long and distinguished pedigree, well antedating both Darwin and any explicit discussion of evolution. While Darwinism rendered many formalist concerns irrelevant, key features of the structuralist agenda could not be encompassed, or even well addressed, by natural selection and its functionalist mechanics. Galton's polyicitous polyhedron provides a strikingly apt metaphor for the two great themes of formalism that continue to demand attention within evolutionary theory, and that the Darwinism of his day (perhaps ours too?) could not adequately comprehend—i.e., discontinuous evolution and internally generated pathways. In other words, "saltation" and "channels." Both of these themes express the more general conception that internal properties of organisms "push back" against external selection.

[6] Notably, Hugo de Vries' mutation theory in the early-twentieth century—in its logic, and on its face—seemed evidently contrary to the central tenets of Darwinism. Kellogg in fact classified de Vries' theory as one of the three major alternatives to natural selection. De Vries explained his theory in the light of Galton's polyhedron, the primary anti-Darwinian metaphor of his day: "Little shocks make it totter; it oscillates round its position of equilibrium and finally returns to it. A slightly stronger push however can make it go so far that it comes to lie on a new side. The oscillations round a position of equilibrium are the fluctuations; the transitions from one position of equilibrium to another correspond to the mutations. The track left behind by the rolling polyhedron can be regarded as the line of descent of the species; each subdivision of this track, corresponding to a side of the polyhedron, representing a particular elementary species; each transitional movement to a new position of mutation" (de Vries 1909, 1:55). Alfred Russel Wallace, in his reasoned opinions, was unreservedly inimical to the mutation theory when it was first proposed. After all, neither selection nor adaptation can play a creative role in evolutionary change if new species arise in single, fortuitous leaps—then the presumed application of Mendel's mutation theory.

This "pushing back" thereby renders evolution as dialectic of inside and outside—i.e., that organisms, in other words, must be conceived as polyicitous polyhedrons.

If "constraint" has become a buzzword of contemporary evolutionary theory, then Galton is smiling, for the structure of his thought has withstood the formalist's ultimate test of timelessness. Notably, while I do not argue for a (purely) saltational change in organ/isms as Galton (apparently) does, I praise his bravery for asserting such a model in the "hey-day" of gradualistic Darwinism, that is, in the late-nineteenth century. We nevertheless can learn a thing or two from Galton's model, I assert. For example, it seamlessly weds the competing concepts of formalism and functionalism together into one coherent line-of-thought. Second, the idea of "facet-flipping" on a polyhedronical object also seamlessly integrates into the model of punctuated equilibrium, which I latently argued for in part one of this book (chapter 2). After all, in Galton's model, there are some serious periods of "nothing happening," *per se*. Then, the polyhedron flips its facet—and lo and behold!—the "new" emerges. If this be not "punctuational origination," I know not what else it could be. Third, Galton's polyicitous polyhedronical model accurately depicts the fossil record as-we-have-it in that it tumbles in a quite "jerky" fashion, which is exactly what one would expect in an evolutionary process marked by punctuated equilibrium. I cannot understand why Galton's model did not develop more cache amongst his contemporaries; it has far too many positives about it to be so lightly dismissed, as it has apparently been over the last 100+ years. Galton's model provides exactly what I expect from a *kenotically*-donated, amorepotent, and uncontrollingly loving God.

Rev. James McCosh's Typical Forms Elaborated

As to another mostly-forgotten figure with key insights that are relevant to this (late-)modern context, and especially this dissertation, allow me to write minimally of the

Reverend James McCosh, who was one of late nineteenth-century liberal theologians friendly to evolution (though not to Darwin's full application in philosophy, *per se*). This man, seemingly, demonstrates that the combatants in the nineteenth-century debate about Darwinism surely cannot be labeled as science vs. religion (see Gould 1999), but rather as expressions of a much deeper struggle between tradition and reform (or openness to change).[7] In 1851 C.E., McCosh published an article titled "Typical Forms" in the *North British Review*, later expanded and published in book form as *Typical Forms and Special Ends in Creation* (1869). The Greek inscription on McCosh's title page of his later text—*typos kai telos* (type and purpose)—epitomizes the argument: McCosh holds that God's order and benevolence may be inferred from two—almost contradictory!—properties that reside in tension within all natural objects: (1) "the principle of order"; and (2) "the principle of special adaptation."[8] McCosh defines his first principle as "a general plan, pattern, or type, to which every given object is made to conform"; and his second as a "particular end, by which each object, while constructed after a general model is, at the same time, accommodated to the situation which it has to occupy, and a purpose which it is intended to serve (McCosh 1869, 1). If we call these two principles "anatomical ground plan" and "adaptation," we are able to make the appropriate evolutionary translation without difficulty.[9]

[7] Notably, McCosh once served as president of Princeton University, where he had a major influence on the career of Henry Fairfield Osborn and other important early American evolutionists.

[8] Darwin carried these two principles forward under the names "Unity of Type" and "Conditions of Existence" (*Origin*, 206; upper case designation in the original). Notably, the word adaptation did not enter biology with the advent of evolutionary theory. The Oxford English Dictionary traces this term to the early seventeenth century in a variety of meanings, all designating the design or suitability of an object for a particular function, the fit of one thing to another. Moreover, the British school of natural theology used "adaptation" in such a manner as to illustrate God's wisdom by the exquisite fit of form to immediate function. In borrowing this term, Darwin followed an established definition while radically revising the cause of the phenomenon. One wonders, however, if he would have been better served by formulating his "own" word instead.

[9] Notably McCosh also argues that the functional argument constitutes the "national signature" of British thought: "The arguments and illustrations adduced by British writers for the last age or two in behalf of the Divine existence, have been taken almost exclusively from the indications in nature of special adaptation of parts" (McCosh 1869, 6).

McCosh was right, in my opinion, in establishing his pre-evolutionary contrast of a "principle of order" and a "principle of special adaptation." Darwin was right in translating this distinction into evolutionary terms as "Unity of Type" and "Conditions of Existence," though he was probably wrong in his decision to yoke the two categories together under a common cause. Of course, this Darwin did by defining unity of type as the historical legacy of previous adaptation, thereby asserting the strict domination of natural selection (see, e.g., Darwin 1859, 206). McCosh notes that the two poles of the dichotomy inhere in every natural object, and any full explanation demands attention to both:

> In taking an enlarged view of the constitution of the material universe, so far as it falls under our notice, it may be discovered that attention, at once extensive and minute, is paid to two great principles or methods of procedure. The one is the Principle of Order, or a general plan, pattern, or type, to which every given object is made to conform with more or less precision. The other is the Principle of Special Adaptation, or particular end, by which each object, while constructed after a general model, is, at the same time, accommodated to the situation which it has to occupy, and a purpose which it is intended to serve. These two principles… meet in the structure of every plant and every animal (McCosh 1869, 1).

McCosh argues further that then-recent discoveries in formalist morphology were viewed as threatening by some biologists (e.g., McCosh cites the French and German schools of ideal morphology):

> The arguments and illustrations adduced by British writers for the last age or two in behalf of divine existence, have been taken almost exclusively from the indications in nature of special adaptation of parts. Hence, when traces were discovered in the last age

> of a general pattern, which had no reference to the comfort of the animal or the functions of the particular plant, the discovery was represented by some as overturning the whole doctrine of final cause; not a few viewed the new doctrine with suspicion or alarm (McCosh 1869, 6–7).

McCosh regards this perceived threat as false, and urges that formalist insights be welcomed—for full explanation demands attention to both poles. McCosh expresses the two key ideas in religious terms as natural illustrations of “lofty wisdom” (formalism) and “providential care” (functionalism). We now call the same themes “constraint” and “adaptation,” but the image of exquisite balance remains every bit as valid today:

> We do not know whether to admire most the all-pervading order which runs through the whole of nature, through all the parts of the plant and animal, and through the hundreds of thousands of different species of plants and animals, or the skillful accommodation of every part, and of every organ, in every species, to the purpose which it is meant to serve. The one leads us to discover the lofty wisdom which planned all things from the beginning, and the enlarged beneficence reaching over all without respect of persons; whereas the other impresses us more with the providential care and special beneficence which, in attending to the whole, has not overlooked any part, but has made provision for every individual member of the myriads of animated beings (McCosh 1869, 439).

As in the case with Galton, McCosh’s statements have a hint of antiquity in terms of language about them, but the above paragraph pretty well speaks for itself, and I will comment upon it no further.

Tentative Conclusions Reached after This Pursuit

As to a few conclusions that I infer after going through all of this material, allow me to

stipulate that I assume that God is sentient, perhaps infinitely so, given the import and placement of sentience in the course of evolution on earth. Additionally, I assume that God is complex, perhaps infinitely so, given the import and placement of complexity in the course of evolution on earth. Thirdly, I assume that God is relational, perhaps infinitely so, given the import and placement of relationality in the course of evolution on earth. Fourthly, I assume that God is beautiful, perhaps infinitely so, given the import and placement of beauty in the course of evolution on earth. Although many authors have sought to proverbially "rescue" traditional natural theology in the contemporary context (see e.g., McGrath 2008; McGrath 2009; McGrath 2011; and McGrath 2015), I think that it may be more kosher to speak of the concept as a "Natural Theology from Below." While I admit that I am favorable unto and gain quite a lot from McGrath and others, I would rather herein to consistently employ the terminology of Natural Theology from Below. Insomuch as this book is an exercise in and exploration of Natural Theology from Below, or even one could say bottom-up Natural Theology, we have learned from the processes of evolution at least what are the attributes of God, if not also how to understand the attributes of God from below.

So what does my theology from below that learns from evolutionary biology help us to understand about the nature of divine involvement? That is, using evolutionary biology as my guide, what does it implicate for divine involvement in the natural world? I conclude that the processes of biological evolution give us metaphors with which to picture (or frame) God's involvement within the world. Overwhelmingly, I also conclude that God and the world cannot be totally separate from each other. There must needs be a confluence between the two: i.e., panentheism. In my opinion, panentheism appropriately models the relationship between God and world because it pictures the two as ultimately and completely and totally dependent upon

the other, much like concentric circles depend upon one another. In this panentheistic analogy, God entirely and exhaustively interpenetrates the world, but at the same time is more than the world. In fact, I am bound—from the preceding chapters—to assert that God could not be God without a world to be in relationship with. Correlatively, the world would be mere chaos (or, even less than chaos) without a God with which to be in relationship.

Further, I also conclude that the notion of divine "action" must be remodeled and reformulated for it to be kosher in today's (late-)modern, scientifically-cognizant world. Pointedly, old—traditional—ways of looking at divine "action" no longer are tenable. So then, there must needs be a reformulation of divine "action" for it to remain a palatable option in the contemporary world. I do this in a couple of manners in this dissertation. Because God totally and entirely interpenetrates the world, God beckons, behooves, and bids the world to draw nigh to him at the *eschaton*. God, then, lures the world toward himself. God's greatest goal (*telos*) for the natural world is the generation of complexity, relationality, and beauty in varied and multifarious forms, along with the extension of diversity and of multiplicities. God lavishes in the generation of diversity and complexity, in and of themselves. This diversity and complexity please God for God desires the multiplicity of forms, as is modeled in the multiplicity of human beings in all of their diversity (e.g.). Moreover, a real capacity to "experience" the lure of the ultimate source of order and novelty allows—or better: enables—the natural world to evolve over the course of time toward more intense forms of beauty. Further, my God of evolution does not coordinate things in advance, nor harbor exclusively the joy of creating. Instead, the God of evolution shares with every entity in the natural world—biotic or non-biotic—their own openness to an indeterminate future. This perspective brings special significance to every "stage"

of nature's unfolding (*evolutio*), including Homo species. After all, as John F. Haught is fond of saying, this is an unfinished universe.

The preceding all leads to the question(s): does biology, in my theology from below, give rise to any potential suggestions as to what it means for God to pull evolution teleologically—or that is, toward a *telos*? While I take issue with the notion of God guiding something, as it means that Godself is behind it, pushing it forward, I do contend that God is ever-before entities, luring, wooing, and drawing them closer to Godself at the *eschaton*, wherein God will be all in all, and whereupon entities will be maximized in their complexity, their relationality, their beauty, and (perhaps?) their diversity—at least that is, in the manner appropriate for that individual entity. For example, a "disabled" person will not suddenly become non-disabled, and also—for example—the ramifications of my own traumatic brain injury will not suddenly disappear; as an aside, I am oft queried about this contention of my own: why, people ask me, do I think that God will not heal me at the *eschaton* of the fullness of my TBI? I respond to them the following: if God were to "heal" me of my TBI, the resulting entity would no longer be "me"—summarily so, I contend that I *am* my damage; I *am* my TBI—to take that "damage" from me would result in an entity that is *not* "me." In my case, indeed, if God is truly marked by *kenotically*-donated, amorepotent, and uncontrolling love, what would be the purpose of "loving me out-of who I *am*" (see McCall, forthcoming-b). But insomuch as the individual entity is able, it will be perfected in beauty, complexity, and relationality, and the Godhead will delight deliciously in the diversity of it all.

I stipulate that Gould's biology gives ample demonstration of this. Indeed, from Gould I contend we can discern the natural world telling us that it is being lured toward God. When circumspectly analyzing Gould's contentions, they give an evidentiary pattern to the cone of

increasing diversity, even though he would utterly deny such an opinion; however, in the ten years post Gould's composition of *Wonderful Life* (1989c), several of the "oddballs" in the Burgess Shale fauna—those that so influenced Gould in his opinions—were accommodated within known *phyla*, as attested to by Conway Morris's *The Crucible of Creation* (1998). And even more so in the twenty some-odd years since the turn of the millennium, still yet further of these Gouldian "oddballs" have found their homes in contemporary *phyla*. So then, it seems as though Gould's distinction between great disparity (i.e., the difference between "types" of life) being present in the Cambrian era, but not great diversity (i.e., the actual number of different "things"), has *not* withstood the test of time. Indeed, an evidentiary pattern to the cone of increasing diversity is ever apparent in the fossil record, as innumerable fossil shales demonstrate throughout the world. This increasing cone of diversity could be viewed as a sort of "progress," as well, even though Gould himself viewed such a word as problematic (even noxious). But we scientists can nevertheless discern a progression through the study of the fossils of previous life (on the whole, though there are outliers).

Furthermore, I contend that the phenomena of punctuated equilibrium is exactly what one would and should expect to find when a *kenotically*-donated, amorepotent, and uncontrollingly loving God is the supervenient influencer of influencers in the (macro-)evolutionary process—that is, if God were to "lure" the universe toward Godself. Indeed, for punctuated equilibrium indicates that (macro-)evolution proceeds by a series of "jerks and fits," which aligns well with the notion of a patient God that I formerly alluded unto that allows "stuff," ultimately, to work themselves out. It also bespeaks genuine relationality, for in the process of (macro-)evolution by punctuated equilibrium, the entities of nature have genuine causal capacity—as does God!—and these two "warring" sides, so to speak, do not at all times cooperate with each other. What does

my theology from below, one that works through panentheistic emergentism, as well as punctuated equilibrium—and thus proceeds through long periods of stasis, with relatively quick "bursts" of arising complexity—tell us about the divine nature, particularly with respect to what the divine entity values? While I have not developed the idea of "panentheistic emergentism" in this dissertation (please reference Philip Clayton's oeuvre for a similar notion of this), I stipulate that the divine nature values complexity, diversity, relationality, beauty, patience, and longsufferingness.

What theological conclusions are undercut by myself and the authors discussed in this dissertation? First and foremost, the entire concept of "special creation" is undercut and falsified. Further, the notion that there is a definite time period regarding the "creation" event is falsified. Thus, the assertion and idea that all of creation proceeded from a single divine act, especially in six calendar days, is falsified and undercut by the evolutionary biological data. In its stead, the somewhat neglected traditional doctrine of *creatio continua* is supported—both by the biological data and myself. In a related sense, "special divine action'" is also undercut by the central tenets of this book. Hence, I am sad to say, there are no miracles. More on this in another book. What theological conclusions are supported or suggested by my interaction with the authors (mainly Gould, Ruse, Conway Morris, Peirce, and Oord) in this book? Pointedly, I assert, God must be found everywhere, or nowhere: i.e., God is—necessarily—imminent within the world. If God is anywhere, he must needs be here in the process, imminently interacting with entities. Further, God exults in diversity and lavishes in beauty. God is patient—with us humans, as well as the other entities that fill nature. And all entities are better for it.

Aside from the zoological interpretation of the animals, what, finally, is the difference between Gould and Conway Morris on "the nature of history?" Gould says that if history were

rerun from the Cambrian, the outcome would be drastically different. The culling by extinction of one Burgess animal rather than another may have been a matter of chance, but "chance" has a ramifying cascade of consequences—subsequent history would have taken another course. This is what is meant by "contingency," at least with reference to Gould. Conway Morris says, contrariwise, that history would have been broadly similar whatever had been culled from the Cambrian—not identical, as if history were simply a deduction from the genome—but following a similar trajectory nonetheless; he bases his argument on the observation, well-known from palaeontology, that similar biological morphologies arise repeatedly in history in response to the demands of a life habit or habitat. The most familiar case is that of the tiger morphology, whereby saber-toothed "cats" arose on at least three occasions from unrelated ancestors. If one animal ancestor had not yielded the cat morphology, then another would have. This is not pure determinism, but the idea nonetheless retains a whiff of the "Great Chain of Being." This is because, for Conway Morris, only Homo sapiens *sapiens* have access to transcendence. While he does not say so explicitly, one nevertheless senses the pull of the divine in Conway Morris's writings.

In *The Crucible of Creation* (1998) and in *Life's Solution* (2003), Conway Morris understands the significance of the Burgess Shale in a completely different way from Gould. Moreover, the subtitle of Gould's *Wonderful Life* (1989c) is "The Nature of History," which makes it clear that, in the eyes of Gould—and I include Conway Morris in this camp as well—they are working toward an interpretation of the entire history of life. On the one side is a representative of the liberal Jewish intellectual tradition, from Cambridge (Massachusetts); on the other side is a conservative churchman, from the Cambridge (UK) "establishment." Be that

as it may, these two gentlemen could hardly come to more different conclusions based upon the same data sets than what has actually transpired.

So what does the preceding analysis of Conway Morris's postulates mean biologically? I suggest two things. First, there is ontological randomness in nature. God uses this randomness in order to achieve the maximum population of the natural world by maintaining dynamic equilibria in complex systems. But, second, this ontological randomness does not preclude the derivation of propensities toward the expression of similar form, even among widely divergent evolutionary lines. These findings strengthen the case that mechanical optimization can drive evolution, contributing to the longstanding debate over the evolutionary roles of randomness versus physical constraints that limit the solutions that are feasible in living creatures. In sum, qualifying physical properties that underlie biological phenomena could help us recognize when an optimal mechanical solution is likely to drive convergent evolution.

Having considered, minimally, what the preceding analysis of Conway Morris's postulates mean biologically and philosophically, what then do they implicate or mean theologically—that is, for those kindred people like me who aver a divine involvement in evolution? I concede that the origin of life on earth was virtually inevitable, given the early chemical composition of oceans and the atmosphere, along with the nature of self-organizing systems (cf. Stuart Kauffman's voluminous oeuvre). While the laws of nature impact the general forms and functions of organisms, the channels are so broad that the details are left to chance. The physical channels do not specify "arthropods, annelids, mollusks, and vertebrates, but, at most, bilaterally symmetrical organisms based on repeated parts" (Gould 1989c, 290). In fact, Gould states, "I suspect that given the composition of early atmospheres and oceans, life's origin was a chemical necessity. Contingency arises later, when historical origin enters the picture of

evolution" (Gould 1989c, 309). Much less do the laws of nature specify the essential answers related to our own—contemporary human—origin, such as why mammals first evolved, why primates then moved from land to the trees, and why the fragile lineage of Homo sapiens *sapiens* emerged and survived in Africa. This evidence suggests that God does not determine the outcome of every scientifically random event, which I herein define as being referent to events that are not calculable in anticipation of their occurrence, but instead constrains randomness by setting broad boundaries, and thereby enabling convergences to occur. Indeed, God thereafter allows organisms to interact according to natural laws, which I have earlier specified as being the result of the embeddedness of Spirit within matter—and hence both diverge and converge constantly—within these constrained boundaries, producing a wide range of beautiful and complex results.

In my opinion, even if the radical reinterpretation of history that Gould (1989c) postulated proves unacceptable in its detail—a position that I am sympathetic to—many biologists have accepted that (macro-)evolution involves more than the mere endless fecundity of genes perpetuating themselves. Consider, for example, the great extinction event at the end of the Permian period (more than 200 million years *after* the Burgess Shale): the variety of vertebrate life on land was extremely and inexorably reduced. Let us peer into the case of *Lystrosaurus*. It, along with a few of its quadruped allies, carried the genetic legacy that was to lead on to the "Age of Dinosaurs," as well as the "Age of Mammals." The advantages in the Permian period, which no doubt aided or secured the survival of one animal rather than another, may have been largely due to luck—or contingency. The advantage may have been, for example, the ability to store water, or some other (nearly) mundane thing as that. The point is that there is no manner with which to predict these advantages in advance. However, it is the case that had a different

animal taken *Lystrosaurus'* place in the Permian, subsequent history would *not* have been a simple replay of the tape. Gould, it seems, comes out the victor in this part of the drama. Moreover, if a meteorite truly killed the dinosaurs 65 MyA and only a few lines of life persisted, it was not because dinosaurs were abysmal failures, but because other series of animals—including our own mammalian line—were somehow "gifted" fortuitously by our lucky stars with a better art of survival. Earth's history, which contains a whole confection of various "stressors"—including such things as manifold climate and sea-level changes, plate tectonics, and extraterrestrial events—has nevertheless danced both without and with life in the midst of these "stressors." While the reductionist approach to (micro-)evolution, especially the unscrambling of developmental genetics, has proven excessively successful in our understanding(s) of the basis for the transformation of one organ into another or even an organ system, but much less for one species into another, these considerable discoveries do *not* explain fully the course of biological "history." Only a contingentist (macro-)evolutionary viewpoint encompasses the entirety of biological history. Full stop.

So, what does my chapter on Peirce's thoughts upon evolutionary developmental teleology, in conjunction with a presentation of his views upon evolutionary causation, mean for (late-)modern theists? I suggest to my patient reader numerous things in what follows: First, Peirce's teleology is "more than a mere purposive pursuit of a predetermined end; it is a developmental teleology" (Peirce 1992, 331). Although Peirce used the term "developmental teleology" only in the discussion of the development of human personality, it is also "applicable to [his] idea of teleology in general: learning from the developmental aspect of our own human purposes, we can inductively infer that all final causes in nature are, at least in principle, subject to evolution" (Hulswit 1996, 197). This means that final causes are indeterminate, which may

help explain the randomness that is everywhere present in our (uni-)multi-verse. Thus—as a second summary point from Peirce—final causes evolve, and they are not static. The evolutionary developmental teleology of Peirce is characterized by the continuity of the (macro-)evolutionary process itself, and this principle of continuity is essential for his evolutionary developmental teleology and his understanding of reality (Peirce 1932-36, 5:436). Third, I maintain that a significantly revised conception of teleology must be developed, if it is to see a resurgence of widespread plausibility in today's somewhat scientifically literate populace. Indeed, as many (late-)modern theologians uniquely emphasizes God's love, such a picture is conducive to a proper theology of evolution, as well as the development of a pertinent theodicy (note: a theology of theodicy is something that I seek to work toward in future books, which include McCall 2021e and McCall 2021c).

Moreover, I contend—fourthly—that the conception of teleology may need serious revision for it to even be maintained as a viable *theological* category. One contribution of Peirce's view is that it pictures teleology as evolving and it is to be seen as a general goal versus having a definite end-state or goal predetermined. This helps explain a lot of the "evolutionary dead-ends" to which our fossil record attests. In dialogue with Peirce, I argue—fifthly—that teleology emerged out of the increasing complexification of life on earth, and continues to be general, not specific. Teleology is grounded in the physical realm via God's *kenosis* of the Spirit into the natural world, but cannot be reduced to it, as the Spirit operates within the natural world as its empowerment, which is argued for in several texts by myself over the last decade or so (see McCall 2008; McCall 2010; and McCall 2011 for a delineation of this position). Such a contention as this bodes well in a thoroughly evolutionary paradigm, such as the one I advocate herein. Furthermore, as a sixth point, in dialogue with Peirce's insistence on the absence of

teleology in anancasm, and the inclusion of it in agapasm, I conceive of teleology as at least partially self-determining. Self-determination is, in fact, fundamental to evolutionary developmental teleology, and (late-)modern relational-theists would want therefore to preserve it. They find a pattern for doing so with respect to how Whitehead says that everything is *self*-creative. In his *agapasm*, Peirce has a condition that is permissible of future growth, and this condition does not negate any tendency that may seem at odds with it. All of these points could and should be reviewed—and possibly appropriated—by the contemporary relational-theist movement.

As such, the "directedness" of the condition, then, may be characterizable in terms of the God that gives of himself in a *kenotical* "act" of amorepotent love without any conditions of potential responses to that amorepotent love, and what responses may fulfill that amorepotent love (see McCall). Rather, it is merely a display of completely reckless overflowing, *uncontrolling* love (see Oord). Seen as such, the many and varied manifestations of complexity that (macro-)evolution has given rise to can be seen as a fulfillment of the teleological goals of God. Such a view places import on even the most disparate species produced by the evolutionary play—everything has worth. God's nature, as it is pictured within the theology and science conversation, is nothing short of "creative-responsive love" (à la Cobb and Griffin 1976), which is based upon, fundamentally, an infinitely *relational* God, who is redemptively present in everything that happens, from beginning to end. Those points comport well with the position of Oord, as laid out in my chapter upon him above.

What's more, causation is a multifaceted event, comprised of previous actions which are determined, future developments that are at least projaculately anticipated by final (teleological) components, and current effects that are affected and perhaps even effected by chance events.

These three assertions are comprised by Peirce in his view that each act of causation involves an efficient component, a final component, and a chance component. This mode of causality—a theological synthesis between *kenosis* and the evolutionary complexification of matter, mediated by the amorepotent, uncontrolling love of God through the creative Spirit—is potent in application to relational-theist theology and the contemporary theology and science discussion, and thus it should be incorporated into both. It is based fundamentally upon my conceptioning of "amorepotent love," as well as the "uncontrolling love" that Thomas Jay Oord has argued for in preceding years.

Oord's posit of God's uncontrolling love is potent in application also to the presence of randomness and chance in the natural environment, a point I made forcefully in the chapters within this book on Gould (chapter two) and Peirce (chapter five). I find that notion to be consonant with my view of a God who lures the natural world to higher levels of complexity, beauty, relationality, diversity, etc. through the processes of biological evolution. As I see it, God does not determine the outcome of random events, but God instead constrains randomness by setting broad boundaries, after which the empowered particles, systems, organisms, and other entities interact cooperatively according to natural laws within the aforementioned boundaries, which produces a wide range of beautiful results. Instead of opposing God and chance, I further contend that chance was God the Spirit's idea and that *she* uses it to ensure the variety, resilience and freedom, not to mention maximal population, necessary to achieve her purposes within the natural world.

I would now like to give some general conclusions regarding my readings on (macro-)evolution and my conception of a *kenotically*-donated and amorepotent God, as well as Oord's portrayal of an uncontrollingly loving God. In noting that the love of the creating Spirit is

kenotically-donated, I intend to draw attention to the idea that she not only gives us love itself, but also *herself* in the very act of love, and that necessarily so. Further, in characterizing love as self-giving, I intend to once again draw attention to the fact that the creating Spirit gives of herself (liberally) to the entities of the natural world. She, in fact, imparts part of herself to it and them, both, in a "*kenotical*" manner. Hence, I say the creating Spirit's love is *kenotically*-donated. In claiming that the love of the Spirit is "amorepotent," I am directly asserting that the enervating and "erotic" love bestowed upon the natural environ by the Spirit is potent. More so, it is literally lovingly-potent. That is, the "erotic" love of the Spirit enables entities and matter to desire, long for, and strive toward greater expressions of sentience. We see this throughout all forms of life. In keeping with a general Whiteheadian framework, then, I in fact assert that all matter, in varying degrees and levels, both display and possess a "hint of sentience." This hint, though, is shown to be most-maximal in the modern Homo species, who definitively express the fullness of the *imago dei*.

Picking up Oord's illustration of uncontrolling love, I gather that he means God gives out of God's fullness, but does not insist on controlling the response(s) of the natural world in response to that impartation of love. Hence, the designation of God's love as "uncontrolling." As such, God does *not* insist on having control. In this dissertation, I transfer Oord's comments regarding "God's love" generally to the creative Spirit's expression of "erotic" love specifically. In so doing, I note that due to her nature primarily being *kenotically*-donated and amorepotent, self-giving love, the creating Spirit *cannot* control other entities, be they animate or not, although she could—and does!—lure, woo, bid and beckon entities toward herself at the *eschaton*. I will again note that this luring, wooing, etc. necessarily includes the increasing of sentience, which I have earlier defined to be the very instantiation of the *imago dei*. Not simply that God "will not"

control other entities, but "cannot!," and that necessarily so. This is the *radical* assertion everywhere made by Oord, and especially in one of his newest titles, *God Can't* (2019). And I join him in it.

I moreover contend that Oord has proposed a doctrine of God's love in numerous texts over the last decade that is adequate both to science and theology. *Defining Love* and *The Nature of Love*, for example, both were published in the calendar year 2010 C.E. His proposal of an adequate doctrine of the love of God therein begins with the claim that love is an essential, necessarily exhibited divine attribute. It is, then, necessarily the case that God always acts intentionally, in sympathetic response to others (including past divine actions), to promote overall well-being (see Oord 2010a). Loving other entities, be they animate or not, is not an arbitrary divine decision but a central and necessary aspect of God's eternal, unchanging nature. Simply stated, God cannot *not* love.[10] It is a necessarily expressed attribute of his person. With the writer of John's gospel, Oord heartily affirms that God is love. Oord is quick to point out, however, that in suggesting that love is an essential aspect of the divine nature, he is not suggesting that God has no choice whatsoever with regard to love. *That* God will love others is necessarily the case. However, *how* God loves others is a free choice on God's part (see Oord 2010b). So we see here both necessity and freedom with regard to God's love. And, I stipulate (as the primary thrust of this book) that necessarily includes the derivation of greater sentience, or that which I define as the *imago dei* itself.

"In ongoing love relations," Oord writes, "we can rest assured that God will always act intentionally, in sympathetic response to others (including God's own past actions), to promote

[10] Here Oord affirms both the theology of Jürgen Moltmann and some of the philosophical conclusions of William L. Rowe. Moltmann (1981, 52–56) argues that divine freedom does not include the freedom *not* to love. Rowe argues that God is not free to do some things—God is not free to make something less than the best of all possible worlds, for example (see Rowe 2004).

overall well-being"; in fact, this "relentless, steadfast love is a necessary aspect of what it means to be divine" (Oord 2010a, 190). From this statement by Oord, I assert that the fact *that* God loves other entities, therefore, is an aspect of God's eternal essence, and is essential to God's person. However, the manner in which God chooses to promote overall well-being in particular instances, arises from *how* God sympathetically responds to other entities in that particular instance itself. There is neither a formula nor circumstances exterior to God that entirely determine what the particular manifestation of love by God will be. How God loves other entities, therefore, is a matter of the divine will (and that alone), somewhat *ad hoc* even—i.e., there is no exterior compulsion. *How* God loves is a free choice on God's part, and in this sense and in this sense alone, God *freely* chooses to love. But the compulsion toward the exhibition of love itself is inalterable and irrevocable. For the God of self-giving, *kenotically*-donated and amorepotent love, the decision to express love at all times comes first. In my conception, "full-orbed" love encompasses what is ordinarily contained within the definition of *agape* love, but it also includes *eros* love, for the latter is the love of co-laborment. In my appropriation of this terminology of *eros* love, I assert that it is the type of love that desires—for example—to expand one's territory or one's domain, which makes it applicable to the modern theory of evolution by natural selection. Evolution—i.e., "descent with modification"—then, recognizes self-giving love, and the goodness thereof, in that species regularly undergo commensalist symbiotic relationships in nature, whereby one is aided by the "other," while the "other" is neither aided nor harmed. This is self-giving, amorepotent love in its entirety, and a proper demonstration of it.

My understanding of necessarily-expressed, "full-orbed" love also includes dimensions of *philia* love. *Philia* is akin to the symbiotic relationship known as mutualism in biology, I assert, especially since *philia* love has historically been associated with friendship or the

interrelatedness of the natural world. Notably, Aristotle (2002, 1155a) indicates that even nonhuman animals can express *philia* love. The relationships marked by *philia*, then, are identified by mutuality, reciprocity, and cooperation, which fits the above biological connotation well. While *agape* or *eros* might benefit from cooperation, reciprocity, and mutuality, those two forms of love do not require any of those three nouns. *Philia* does. I contend, in fact, that God's *kenosis* of the Spirit *into* the natural world amounts to self-giving, betrothed love through self-donation. God, then, expresses *philia* by working cooperatively with entities—and also by aiding entities to work cooperatively with other entities—to increase the common good. Notably, Oord defines *philia* as acting intentionally, in response to God and others, to promote overall well-being by seeking to establish deeper levels of cooperative friendship. *Philia*, then, also is the love of co-laborment.

Oord points out that *philia*, both the word and the concept, plays a significant role in the New Testament. He notes that we have a strong biblical basis for affirming the notion that God expresses *philia* often in his relations with the "other" (Oord 2004). While God's *agape* refers to repaying evil with good and *eros* refers to creating and enhancing value, *philia* refers to God's work to promote friendship with and within those entities capable of such. *Philia* is *alongside* love (Oord 2010b, 114). Like *agape* and *eros*, an entity's expression(s) of *philia* require God's prevenient and empowering action. God is both the exemplar of *philia* as well as the source of *philia*. *Philia* is a form of love that works *alongside of* God and others to promote overall well-being. We are, in a very real sense, God's fellow *agents of creativity* and God's fellow *workers*. God's love, however, is "full-orbed"—i.e., composed of *agape*, *eros*, and *philia* dimensions.

The union, then, of *agape*, *eros*, and *philia* love could be expressed as "mutual aid" (see Kropotkin), or "full-orbed" love (see Oord 2007). Flourishing lives—be they divine, human, or

some other mammal—I strongly aver, consistently and necessarily express full-orbed love. Oord himself suggests that Process philosophy can aid one to see that full-orbed love plays an important part in the work to increase the common good of society as a whole. Indeed, full-orbed love repays evil with good as *agape* does. Such a full-orbed love additionally welcomes the intrinsic value and beauty in others, just like *eros* love does. Also, such full-orbed love recognizes the import of friendship and mutuality as does *philia* love. Oord's notion that God's love is full-orbed presupposes that God is a thoroughly relational being—and, as relational—God both *affects* and is *affected* by those with whom God relates. In a greatly positive development of the last generation or so—almost invariably—contemporary relational theologians have rejected the idea that God is an aloof monarch uninfluenced by the "other." Instead, relational theologians affirm that God suffers and is passible, which means that God is influenced by the ups and downs, joys and sorrows, sins and loves of other entities. God truly cares, and is, in fact, the *most moved mover* (see Pinnock 2001; Williams 2021).

Although God's creaturely entities truly affect—and thereby effect change in—this truly relational God, God's eternal nature of *kenotically*-donated, self-giving, amorepotent and uncontrolling love remains unchanging. That is, God's eternal nature is fixed. God's nature is love, and that nature never alters. However, the responses of entities to God's drive toward greater expressions of sentience in (macro-)evolution influence the particular way—*agape*, *eros*, *philia*—that God chooses to love the "other." The theology that Oord proposes suggests that God's own characteristics and God's own relations with others influence the extent of divine love, as well as the manifestations of divine love. God is always everywhere present to all entities (theologians refer to this as *omnipresence*). This fact of God's loving omnipresence, indeed then plays a distinctively crucial role for understanding divine involvement in relation to

the natural world. Divine omnipresence pertains directly to love's breadth and width, and height and depth. Indeed, because God is present to all entities at all times—and because God loves perfectly in a *kenotically*-donated, self-giving, amorepotent, and uncontrolling manner—all entities within the natural world are always necessarily loved. These entities in the natural world are in fact, smothered with love—pelted by it one might say. Moreover, since God commands that we necessarily show "self-giving," "self-donating," and amorepotent love, we humans—as the pinnacle of the natural world heretofore with regard to the derivation of sentience—therefore indeed have the *full* ability to love others as *kenotically*-donating entities, just as the imbibified Spirit does. In fact, when we act as a genuine conduit and amplifier of the imbibified Spirit's self-donating and self-giving love, we humans can truly and entirely and infinitely love others, just as God does. Of course, we cannot expect that we humans will always love alike unto how God does, *per se*, because we do not have an eternal and unchanging nature that is necessarily inclined toward love. However, we are at least always *able* to do it—however feebly and intermittently.

I further assert that my contemporary reconceptioning of Gouldian contingency—through the lens of Peirce—as one in which the general *telos* and goal of evolution is increased complexity and the generation of diversity, broadly, and more specifically increasingly sentient creatures, is both a plausible and fruitful postulation. I contend that God, the ultimate reality, intrinsically delights in both complexity and diversity, for the generation of greater complexity leads to entities that express greater sentience with which he may have a relationship, and the production of increased diversity because God lavishes in the multiplicity of beauty. Moreover, I maintain that this general *telos* and goal is accomplished through the initial *pouring out* of the Spirit, or that which I have referred to above and elsewhere as imbibification, into chaotic

nothingness (*kenosis*, as I have defined it). It then continues through the exploration of possible ends via the Spirit of God. Moreover, then—also through the accompaniment of the Spirit throughout the emergentist process—it culminates with the arrival of the evolutionary experiment known as Homo sapiens *sapiens*, which are fully sentient creatures.

So then, this all amounts to—as stipulated at the onset of this book—panentheistic contingentist divine involvement by a *kenotically*-donated, amorepotent, and uncontrollingly loving Spirit involving herself in the processes of (macro-)evolution in order to maximize complexity, relationality, beauty in varied and multifarious forms, along with the extension of diversity and increases of multiplicity in the natural world, etc. These "results" are accomplished by not only the Spirit, but also by *kenotical* creativity through cosmological causes, amounting to Spirit-derived causation through mutual immanence and contiguity with the natural world. That is, the *kenotically*-donated, amorepotent, uncontrolling, and *kenotical* Spirit enervates the creative advance into the future. In a sense, though, this creative advance into the future is also entity-created and entity-directed. This is a position of full mutuality between the natural world and God. So… to put a cap on this dissertation, (macro-)evolutionary pathways reside within the parameters of the *kenotical* Spirit's amorepotent, uncontrollingly loving intentions—and she, in fact, superintends them in the drive toward greater expressions of sentience within the natural world, which is the very definition of *imago dei*.

References

Adams, Robert Merrihew. 1999. *Finite and Infinite Goods: A Framework for Ethics*. Oxford: Oxford University Press.

Aristotle. 2002. *Aristotle*: *Nicomachean Ethics*. Edited by Sarah Broadie. Translated by Christopher Rowe. Oxford: Oxford University Press.

Ayala, Francisco J. 1974. "The Concept of Biological Progress." In *Studies in the Philosophy of Biology: Reduction and Related Problems*, edited by Francisco Jose Ayala and Theodosius Dobzhansky, 339–54. London: Macmillan.

Ayala, Francisco J. 1982. "The Evolutionary Concept of Progress." In *Progress and Its Discontents*, edited by Gabriel A. Almond, Marvin Chodorow, and Roy Harvey Pearce, 106–24. Berkeley: University of California Press.

Ayala, Francisco J. 1988. "Can 'Progress' be Defined as a Biological Concept?" In *Evolutionary Progress*, edited by Matthew H. Nitecki, 75–96. Chicago: University of Chicago Press.

Bartholomew, David J. 1984. *God of Chance*. London: SCM.

Bateson, William. 1894. *Materials for the Study of Variation*. London: Macmillan.

Bateson, William. 1909. "Heredity and Variation in Modern Lights." In *Darwin and Modern Science*, edited by A. C. Seward, 85–101. Cambridge: Cambridge University Press.

Benton, Michael J. 1987. "Progress and Competition in Macroevolution." *Biology Review* 62:305–38.

Bergmann, Sigurd. 2005. *Creation Set Free: The Spirit as Liberator of Nature*. Translated by Douglass W. Stott. Grand Rapids, MI: Eerdmans.

Blumer, Michael J. F., Luitfried v. Salvini-Plawen, Reinhard Kikinger, and Thomas Büchinger. 1995. "Ocelli in a Cnidaria Polyp: The Ultrastructure of the Pigment Spots in *Stylocoronella riedli* (Scyphozoa, Stauromedusae)." *Zoomorphology* 115:221–27.

Bonhoeffer, Dietrich. 1971. *Letters and Papers from Prison*. Enlarged ed. London: SCM.

Bonner, John T. 1987. *The Evolution of Complexity*. Princeton: Princeton University Press.

Bowler, Peter J. 1976. *Fossils and Progress*. New York: Science History.

Bowler, Peter J. 1984. *Evolution: The History of An Idea*. 4th ed. Berkeley: University of California Press.

Boyle, Robert. 1688. *A Disquisition About the Final Causes of Natural Things*. London: John Taylor.

Bradnick, David, and Bradford McCall. 2018. "Making Sense of Emergence: A Critical Engagement with Leidenhag, Leidenhag, and Yong." *Zygon: Journal of Science and Religion* 53 (1): 240–57.

Brown, David. 2011. *Divine Humanity: Kenosis and the Construction of a Christian Theology*. Waco, TX: Baylor University Press.

Browne, Janet E. 1980. "Darwin's Botanical Arithmetic and the 'Principle of Divergence,' 1854–1858." *Journal of the History of Biology* 13 (1): 53–89.

Brümmer, Vincent. 1993. *The Model of Love: A Study in Philosophical Theology*. Cambridge: Cambridge University Press.

Bulgakov, Sergius. 1988. *The Orthodox Church*. Crestwood, NY: St. Vladimir's.

Bulgakov, Sergius. 1993. *Sophia, the Wisdom of God: An Outline of Sophiology*. Hudson, NY: Lindisfarne.

Bulgakov, Sergius. 2002. *The Bride of the Lamb*. Translated by Boris Jakim. Grand Rapids, MI: Eerdmans.

Bulgakov, Sergius. 2004. *The Comforter*. Translated by Boris Jakim. Grand Rapids, MI: Eerdmans.

Bulgakov, Sergius. 2012. *The Unfading Light*. Translated by Thomas A. Smith. Grand Rapids, MI: Eerdmans.

Cheetham, Alan H., and Jeremy B. C. Jackson. 1995. "Process from Pattern: Tests for Selection Versus Random Change in Punctuated Bryzoan Speciation." In *New Approaches to Speciation in the Fossil Record*, edited by Douglass H. Erwin and Robert L. Anstey, 184–207. New York: Columbia University Press.

Clatterbaugh, Kenneth. 1999. *The Causation Debate in Modern Philosophy, 1671-1739*. London: Routledge.

Clayton, Philip. 2005. "Kenotic Trinitarian Panentheism." *Dialog: A Journal of Theology* 44(3): 250–55.

Clayton, Philip. 2018. *God and Gravity: A Philip Clayton Reader on Science and Theology*. Edited by Bradford McCall. Eugene, OR: Cascade Books.

Cobb, John B., Jr., and David Ray Griffin. 1976. *Process Theology: An Introductory Exposition*. Philadelphia: Westminster.

Colyer, Peter J. 2013. *The Self-Emptying God: An Undercurrent in Christian Theology Helping the Relationship with Science*. Cambridge: Cambridge Scholars.

Conway Morris, Simon. 1993. "Ediacaran-Like Fossils in Cambrian Burgess Shale-Type Faunas on North America." *Paleontology* 36 (3): 593–635.

Conway Morris, Simon. 1998. *The Crucible of Creation: The Burgess Shale and the Rise of Animals*. New York: Oxford University Press.

Conway Morris, Simon. 2003. *Life's Solution: Inevitable Humans in a Lonely Universe*. New York: Cambridge University Press.

Conway Morris, Simon. 2015. *The Runes of Evolution: How the Universe Became Self-Aware*. West Conshocken, PA: Templeton.

Conway Morris, Simon, and Stephen Jay Gould. 1998. "Showdown on the Burgess Shale." *Journal of Natural History* 107:48–55.

Corrington, Robert S. 1993. *An Introduction to C. S. Peirce: Philosopher, Semiotician and Ecstatic Naturalist*. Lanham, MD: Rowman and Littlefield.

Corsi, Peter. 1978. "The Importance of French Transformist Ideas for the Second Volume of Lyell's 'Principles of Geology.'" *British Journal of the History of Science* 11:221–44.

Darwin, Charles. 1842. *The Structure and Distribution of Coral Reefs: Being the First Part of the Geology of the Voyage of the Beagle, under the Command of Capt. Fitzroy, R.N. during the Years 1832 to 1836*. London: Smith, Elder and Co.

Darwin, Charles. 1859. *On the Origin of Species by Means of Natural Selection, or Preservation of Favored Races in the Struggle for Life*. London: Murray.

Darwin, Charles. 1868. *The Variation of Animals and Plants under Domestication*. 2 vols. London: Murray.

Darwin, Charles. 1871. *The Descent of Man, and Selection in Relation to Sex*. London: John Murray.

Darwin, Charles. 1881. *The Formation of Vegetable Mould, through the Action of Worms, with Observations on their Habitats*. London: Murray.

Darwin, Charles. 1887. *The Life and Letters of Charles Darwin, Including an Autobiographical Chapter*. Edited by Francis Darwin. 3 vols. London: Murray.

Darwin, Charles. 1903. *More Letters of Charles Darwin: A Record of His Work in a Series of Hitherto Unpublished Letters*. Edited by Francis Darwin and A. C. Seward. 2 vols. London: Murray.

Darwin, Charles. 1975. *Charles Darwin's Natural Selection: Being the Second Part of His Big Species Book Written from 1856 to 1858*. Edited by R. C. Stauffer. Cambridge: Cambridge University Press.

Darwin, Charles. 1987a. *1844–1846*. Edited by Frederick Burkhardt and Sydney Smith. Vol. 3 of *The Correspondence of Charles Darwin*, edited by Frederick Burkhardt, Sydney Smith, James A. Secord, and Alison M. Pearn. Cambridge, UK: Cambridge University Press, 1985–.

Darwin, Charles. 1987b. *Charles Darwin's Notebooks, 1836–1844: Geology, Transmutation of Species, Metaphysical Enquiries*. Transcribed and edited by Paul H. Barrett, Peter J. Gautrey, Sandra Herbert, David Kohn, and Sydney Smith. Cambridge: Cambridge University Press.

Davies, Brian. 1986. *Storm Over Biology: Essays on Science, Sentiment, and Public Policy*. Buffalo, NY: Prometheus.

Desmond, Adrian, and James Moore. 1991. *Darwin: The Life of a Tormented Evolutionist*. New York: W. W. Norton.

de Vries, Hugo. 1909. *The Mutation Theory*. 2 vols. New York: D. Appleton.

Dobzhansky, Theodosius. 1967. *The Biology of Ultimate Concern*. New York: New American Library.

Eble, Gunther J. 1999. "On the Dual Nature of Chance in Evolutionary Biology and Paleobiology." *Paleobiology* 25 (1): 75–87.

Edwards, Denis. 2004. *Breath of Life: A Theology of the Creator Spirit*. Maryknoll, NY: Orbis.

Eldredge, Niles. 1979. "Alternative Approaches to Evolutionary Theory." In *Models and Methodologies in Evolutionary Theory*, edited by J. H. Schwartz and H. B. Rollins, 7–19. Pittsburgh: Carnegie Museum of Natural History.

Eldredge, Niles, and Stephen Jay Gould. 1972. "Punctuated Equilibria: An Alternative to Phyletic Gradualism." In *Models in Paleobiology*, edited by Thomas J. M. Schopf, 82–115. San Francisco: Freeman, Cooper and Co.

Eldredge, Niles, and Stephen Jay Gould. 1997. "On Punctuated Equilibria." *Science* 276, no. 5311 (April 18): 337–41.

Ellis, George F. R. 2001. "Kenosis as a Unifying Theme for Life and Cosmology." In *The Work of Love: Creation as Kenosis*, edited by John C. Polkinghorne, 107–26. Grand Rapids, MI: Eerdmans.

Ephraem. 1737. *Sancti patris nostri Ephraem Syri opera omnia qua exstant Graece, Syriace, Latine, in sex tomos distributa*, edited by Stephanus Evodius Assemani. Vol. 4. Rome: Vatican.

Evans, C. Stephen, ed. 2006. *Exploring Kenotic Christology: The Self-Emptying of God*. Vancouver, BC: Regent College Publishing.

Falconer, Hugh. 1868. *Palaeontological Memoirs and Notes*, edited by Charles Murchison. 2 vols. London: Hardwicke.

Fiddes, Paul S. 2001. "Creation Out of Love." In *The Work of Love: Creation as Kenosis*, edited by John C. Polkinghorne, 167–91. Grand Rapids, MI: Eerdmans.

Fiddes, Paul S. 1988. *The Creative Suffering of God*. Oxford: Clarendon.

Galton, Francis. 1869. *Hereditary Genius: An Inquiry into Its Laws and Consequences*. Revised ed. New York: D. Appleton.

Galton, Francis. 1889. *Natural Inheritance*. London: MacMillan.

Galton, Francis. 1894. "Discontinuity in Evolution." *Mind* 11:362–72.

Ghiselin, Michael T. 2009. "Darwin: A Reader's Guide." *Occasional Papers for the California Academy of Sciences* 155:1–185.

Goethe, Johann Wolfgang von. 1790. *Versuch die Metamorphose der Pflanzen zu erklären*. Gotha: Ettinger.

Goldschmidt, Richard P. 1940. *The Material Basis of Evolution*. New Haven, CT: Yale University Press.

Goodwin, Brian. 1994. *How the Leopard Changed Its Spots: The Evolution of Complexity*. New York: Simon & Schuster.

Gould, Stephen Jay. 1966. "Allometry and Size in Ontogeny and Phylogeny." *Biological Reviews* 41:587-640.

Gould, Stephen Jay. 1967. "Evolutionary Patterns in Pelycosaurian Reptiles: A Factor-Analytic Study." *Evolution* 21:385-401.

Gould, Stephen Jay. 1977. "Eternal Metaphors of Palaeontology." In *Patterns of Evolution as Illustrated by the Fossil Record*, edited by A. Hallam, 1–26. Amsterdam: Elsevier.

Gould, Stephen Jay. 1980. "G. G. Simpson, Paleontology, and the Modern Synthesis." In *The Evolutionary Synthesis*, edited by Ernst Mayr and William B. Provine, 153–172. Cambridge, MA: Harvard University Press.

Gould, Stephen Jay. 1982a. "Darwinism and the Expansion of Evolutionary Theory." *Science* 216, no. 4544 (April 23): 380–87.

Gould, Stephen Jay. 1982b. "Introduction to Theodosius Dobzhansky, 'Genetics and the Origin of Species.'" In *The Columbia Classics in Evolution Series*, edited by Niles Eldredge and Stephen Jay Gould, xvii–xli. New York: Columbia University Press.

Gould, Stephen Jay. 1989a. "A Developmental Constraint in *Cerion*, with Comments on the Definition and Interpretation of Constraint in Evolution." *Evolution* 43, 516–39.

Gould, Stephen Jay. 1989b. "The Wheel of Fortune and the Wedge of Progress." *Natural History* 98 (3): 14–21.

Gould, Stephen Jay. 1989c. *Wonderful Life: The Burgess Shale and the Nature of History*. New York: W. W. Norton.

Gould, Stephen Jay. 1991. *Bully for Brontosaurus: Reflections in Natural History*. New York: W. W. Norton.

Gould, Stephen Jay. 1992. "Constraint and the Square Snail: Life at the Limits of a Covariance Set. The Normal Teratology of *Cerion disforme*." *Biological Journal of the Linnean Society* 47, no. 4 (December): 407–37.

Gould, Stephen Jay. 1996a. *Full House: The Spread of Excellence from Plato to Darwin*. New York: Harmony.

Gould, Stephen Jay. 1996b. "The Shape of Life." *Art Journal* 1:44–46.

Gould, Stephen Jay. 1998a. *Leonardo's Mountain of Clams and the Diet of Worms: Essays on Natural History*. New York: Harmony Books.

Gould, Stephen Jay. 1998b. "On Embryos and Ancestors." *Natural History* 107 (7/8): 20-22, 58-65.

Gould, Stephen Jay. 1999. *Rocks of Ages: Science and Religion in the Fullness of Life*. New York: Ballantine.

Gould, Stephen Jay. 2002. *The Structure of Evolutionary Theory*. Cambridge, MA: Belknap of Harvard University Press.

Gould, Stephen Jay. 2006. *The Richness of Life: The Essential Stephen Jay Gould*. Edited by Paul McGarr and Steven Rose. London: Jonathan Cape.

Gould, Stephen Jay. 2007. *Punctuated Equilibrium*. Cambridge, MA: Belknap Press of Harvard University Press.

Gould, Stephen Jay, and Niles Eldredge. 1977. "Punctuated Equilibria: The Tempo and Mode of Evolution Reconsidered." *Paleobiology* 3:115–51.

Gould, Stephen Jay, and Niles Eldredge. 1983. "Darwin's Gradualism." *Systematic Zoology* 32 (4): 444–45.

Gould, Stephen Jay, and Niles Eldredge. 1993. "Punctuated Equilibrium Comes of Age." *Nature* 366:223–27.

Gould, Stephen Jay, Norman L. Gilinsky, and Rebecca Z. German. 1987. "Asymmetry of Lineages and the Direction of Evolutionary Time." *Science* 236, no. 4807 (June 12): 1437–41.

Gould, Stephen Jay, and Richard C. Lewontin. 1979. "The Spandrels of San Marco and the Panglossian Paradigm: A Critique of the Adaptationist Programme." *Proceedings of the Royal Society of London B: Biological Sciences* 205 (1161): 581–98.

Gould, Stephen Jay, David M. Raup, John J. Seposki Jr., Thomas J. M. Schopf, and David S. Simberloff. 1977. "The Shape of Evolution: A Comparison of Real and Random Clades." *Paleobiology* 3:23–40.

Gould, Stephen Jay, and Elizabeth Vrba. 1982. "Exaptation—A Missing Term in the Science of Form." *Paleobiology* 8:4–15.

Grant, Colin. 2001. *Altruism and Christian Ethics*. Cambridge: Cambridge University Press.

Grant, Colin. 1996. "For the Love of God: Agape." *Journal of Religious Ethics* 24, no. 1: 3–21.

Greene, John C. 1977. "Darwin as a Social Evolutionist." *Journal of the History of Biology* 10:1–27.

Gruber, Howard E., and Paul H. Barrett. 1974. *Darwin on Man: A Psychological Study of Scientific Creativity*. New York: Dutton.

Gunton, Colin E. 1997. *The Promise of Trinitarian Theology*. 2nd ed. London: T & T Clark.

Haas, O. and G. G. Simpson. 1946. "Analysis of Some Phylogenetic Terms with Attempts at Redefinition." *Proceedings of the American Philosophical Society* 90: 319–49.

Hanson, Norwood R. 1961. *Patterns of Discovery: An Inquiry into the Conceptual Foundations of Science*. Cambridge: Cambridge University Press.

Hartshorne, Charles. 1934. "Ethics and the New Theology." *The International Journal of Ethics* 45 (1): 90–101.

Hartshorne, Charles. 1941. *Man's Vision of God*. Chicago: Willit, Clark and Co.

Hartshorne, Charles. 1975. *Beyond Humanism: Essays in the New Philosophy of Nature*. Gloucester, MA: Peter Smith.

Hausman, Carl R. 1993. *Charles S. Peirce's Evolutionary Philosophy*. Cambridge: Cambridge University Press.

Hebblethwaite, Brian. 1989. Review of *God's Action in the World*, by Maurice F. Wiles. *Modern Theology* 5, no. 2 (January): 187-90.

Hefner, Philip. 1993. *The Human Factor: Evolution, Culture and Religion*. Minneapolis: Fortress.

Heyward, Carter. 1996. "Lamenting the Loss of Love: A Response to Colin Grant." *Journal of Religious Ethics*, 24 (1): 23–28.

Honderich, Ted. 1993. *How Free Are You? The Determinism Problem*. Oxford: Oxford University Press.

Hull, David L. 1985. "Darwinism as a Historical Entity." In *The Darwinian Heritage*, edited by David Kohn, 773–812. Princeton: Princeton University Press.

Hulswit, Menno. 1996. "Teleology: A Peircean Critique of Ernst Mayr's Theory." *Transactions of the Charles S. Peirce Society* 32, no. 2 (Spring): 182-214.

Hulswit, Menno. 1997. "Peirce's Teleological Approach to Natural Classes." *Transactions of the Charles S. Peirce Society* 33, no. 3 (Summer): 722–72.

Hulswit, Menno. 2002. *From Cause to Causation: A Peircean Perspective*. New York: Springer.

Huxley, Julian. 1953. *Evolution in Action*. London: Chatto and Windus.

Huxley, Thomas Henry. 1894. "Evolution and Ethics." In *Evolution and Ethics, and Other Essays*. Vol. 9 of *Collected Essays by T. H. Huxley*. New York: D. Appleton.

Huxley, Thomas Henry. 1901. *Life and Letters of Thomas Henry Huxley*. Vol. 1, edited by Leonard Huxley. New York: D. Appleton.

Jablonski, David, and David J. Bottjer. 1990. "The Ecology of Evolutionary Innovation: The Fossil Record." In *Evolutionary Innovations*, edited by Matthew H. Nitecki, 253–88. Chicago: University of Chicago Press.

Jackson, Jeremy B. C., and Alan H. Cheetham. 1999. "Tempo and Mode of Speciation in the Sea." *Trends in Ecology & Evolution* 14:72–77.

Jeanrond, Werner G. 2010. *A Theology of Love*. New York: T & T Clark.

Jeeves, Malcolm A., and R. J. Berry. 1998. *Science, Life and Christian Belief: A Survey and Assessment*. Leicester: Apollos.

Johanson, Donald, and Blake Edgar. 1996. *From Lucy to Language*. New York: Simon & Schuster.

Jüngel, Eberhard. 1983. *God as the Mystery of the World: On the Foundation of the Theology of the Crucified One in the Dispute between Theism and Atheism*, translated by Darrell L. Guder. Edinburgh: T. & T. Clark.

Kellogg, Vernon L. 1907. *Darwinism Today*. London: G. Bell & Sons.

Kirsch, John A. W. 1977. "The Six-Percent Solution: Second Thoughts on the Adaptedness of the Marsupialia." *American Scientist* 65, no. 3 (May–June): 276–88.

Kirschner, Marc, and John Gerhart. 1998. "Evolvability." *Proceedings of the National Academy of Sciences of the United States of America* 95, no. 15 (July): 8420–27.

Koenigswald, Wigham V., and Francisco Goin. 2000. "Enamel Differentiation in South American Marsupials and a Comparison of Placental and Marsupial Enamel." *Palaeontographica Abt. A* 255, no. 4-6 (January): 129–68.

Lamarck, Jean-Baptiste-Pierre-Antoine de Monet, chevalier de. 1809. *Philosophie zoologique, ou exposition des considerations relatives a l'histoire naturelle des animaux*. 2 vols. Paris: Dentu.

La Rochefoucauld, Francois, duc de. 1871. *Reflections, or Sentences and Moral Maxims*, translated by J. W. Willis Bund and J. Hain Friswell. New York: Scribner, Welford and Co.

Lessa, Enrique P., and Richard A. Fariña. 1996. "Reassessment of Extinction Patterns among the Late Pleistocene Mammals of South America." *Palaeontology* 39 (3): 651–62.

Levinton, Jeffrey S. 2004. *Genetics, Paleontology and Macroevolution*, 2nd ed. Cambridge: Cambridge University Press.

Lewis, C. S. 2017. *The Four Loves*. San Francisco: HarperOne.

Linahan, Jane E. 2005. "Experiencing God in Brokenness: The Self-Emptying of Holy Spirit in Moltmann's Pneumatology." In *Encountering Transcendence: Contributions to a Theology of Religious Experience*, edited by Lieven Boeve, Hans Geybels, and Stijn Van den Bossche, 165–84. Belgium: Peeters.

Lodahl, Michael E. 2004. "Creator-Logos-Spirit: Pursuing Trinitarian Reflection as a Critique of Creatio Ex Nihilo." Paper presented at the 2004 Annual Meeting of the American Academy of Religion, San Antonio, TX, November 21.

Losee, John. 1972. *A Historical Introduction to the Philosophy of Science*. London: Oxford University Press.

Lovejoy, Arthur O. 1936. *The Great Chain of Being: A Study of the History of an Idea*. Cambridge: Harvard University Press.

Macquarrie, John. 1977. *Principles of Christian Theology*, 2nd ed. New York: Scribner.

Manton, Sidnie M. 1978. *The Arthropoda: Habits, Functional Morphology and Evolution*. Oxford: Oxford University Press.

Maynard Smith, John. 1992a. "J. B. S. Haldane." In *The Founders of Evolutionary Genetics*, edited by S. Sarkar, 37–51. Dordrecht: Kluwer Academic Publishers.

Maynard Smith, John. 1992b. "Taking a Chance on Evolution." *New York Review of Books* 39:36.

Maynard Smith, John, Richard Burian, Stuart A. Kauffman, P. Alberch, J. Campbell, Brian Goodwin, Richard Lande, David M. Raup, and Lewis Wolpert. 1985. "Developmental Constraints and Evolution." *Quarterly Review of Biology* 60:265–87.

Mayr, Ernst. 1963. *Animal Species and Evolution*. Cambridge, MA: Harvard University Press.

Mayr, Ernst. 1972. "Lamarck Revisited." *Journal of the History of Biology* 5:55–94.

Mayr, Ernst. 1991. *One Long Argument: Charles Darwin and the Genesis of Modern Evolutionary Thought*. Cambridge: Harvard University Press.

Mayr, Ernst. 1992. "Speciational Evolution and Punctuated Equilibria." In *The Dynamics of Evolution*, edited by Albert Somit and Steven A. Peterson, 21–53. Ithaca, NY: Cornell University Press.

McCall, Bradford. 2008. "Kenosis of the Spirit into Creation." *Crucible: Theology & Ministry* 1, no. 1 (May): 1-14. https://www.crucibleonline.net/past-editions/inaugural-issue-vol-1-no-1-may-2008/.

McCall, Bradford. 2009. "Emergence Theory and Theology: A Wesleyan–Relational Perspective." Wesleyan Theological Journal 44 (2): 189–207.

McCall, Bradford. 2010. "Emergence and Kenosis: A Theological Synthesis." *Zygon: Journal of Science and Religion* 45 (1): 149–64.

McCall, Bradford. 2011. "Emergence and Kenosis: A Wesleyan Perspective." In *The Future of Wesleyan Theology: Essays in Honor of Laurence Wood*, edited by Nathan Crawford, 155–70. Eugene, OR: Pickwick.

McCall, Bradford. 2017a. "Causation, Vitalism, and Hume." *Philosophy and Theology* 29 (2): 341–51.

McCall, Bradford. 2017b. "A Critical Analysis and Response to Hume from a Pneumatological

Perspective." *Journal of Pentecostal Theology* 26 (2): 233–51.

McCall, Bradford. 2017c. "The God of Chance." In *Uncontrolling Love: Essays Exploring the Love of God, with Introductions by Thomas Jay Oord*, edited by Chris Baker, Gloria Coffin, Craig Drurey, Graden Kirksey, Lisa Michaels, and Donna Ward, 221–24. San Diego: SacraSage.

McCall, Bradford. 2017d. "Thomistic Personalism in Dialogue with Kenosis." *Studia Ełckie* 19 (1): 21–32.

McCall, Bradford. 2018. *A Modern Relation of Theology and Science Assisted by Emergence and* Kenosis. Eugene, OR: Wipf and Stock.

McCall, Bradford. 2019a. "The God of Chance and Purpose." *Theology and Science* 17 (1): 133–42.

McCall, Bradford. 2019b. "Necessary, Kenotically-Donated, and Self-giving Love." *Studia Ełckie* 21(2): 231-41. DOI: 10.32090/SE.210210.

McCall, Bradford. 2019c. "Whitehead, Creativity, and the Immanently Creative Spirit." *Zygon: Journal of Science and Religion* 54 (2): 337–50.

McCall, Bradford. 2020a. *Evolution: Secular or Sacred?* With a foreword by Thomas Jay Oord. Eugene, OR: Wipf and Stock.

McCall, Bradford. 2020b. "Nygren and Oord on Love: A Critique." *Journal of Process Studies* 49 (2): 275–91.

McCall, Bradford. 2021a. "The Erotic Creating Spirit: How Erotic Love Characterizes the Spirit of Creativity." Unpublished manuscript, last modified 2021. Microsoft Word file.

McCall, Bradford. 2021b. "Expelling the Perpetrator: Male on Male Sexual Abuse and the Journey Thereafter." Unpublished manuscript, last modified 2021. Microsoft Word file.

McCall, Bradford. 2021c. "Losing the Time: A Theology of Traumatic Brain Injury." Unpublished manuscript, last modified 2021. Microsoft Word file.

McCall, Bradford. 2021d. "Pantheism and Paul Tillich: Mystical Immanence and Divine Involvement in an Evolutionary World." In *Why Tillich? Why Now?*, edited by Thomas G. Bandy, 127-44. Macon, GA: Mercer University Press.

McCall, Bradford. 2021e. "Redeeming the Time: A Personal Journey Through Traumatic Brain Injury." Unpublished manuscript, last modified 2021. Microsoft Word file.

McCall, Bradford. 2022. *The God of Chance and Purpose: Divine Involvement in a Secular Evolutionary World*. With a Foreword by John F. Haught. Eugene, OR: Wipf and Stock.

McCall, Bradford. Forthcoming-a. *Chance, Life, and God: How Might These Three Abide?* With a Foreword by Philip Clayton. Grasmere, ID: SacraSage.

McCall, Bradford. Forthcoming-b. *Macroevolution, Contingency, and Uncontrolling, Amorepotent Love: How God Works in the (Late-)Modern World*. With a foreword by Michael Ruse. Eugene, OR: Pickwick.

McCall, Bradford, ed. Forthcoming-c. *The Peacocke's Tale: An Arthur R. Peacocke Reader on Science and Faith*. With a Foreword by Philip Clayton. Eugene, OR: Wipf and Stock.

McCall, Bradford, ed. Forthcoming-d. *Reading Ruse: Michael Ruse on Darwinism, Science, and Faith*. With an autobiographical chapter by Michael Ruse, a foreword by John F. Haught, and a postscript by Robert J. Richards. Eugene, OR: Pickwick.

McCosh, James. 1869. *Typical Forms and Special Ends in Creation*. New York: Robert Carter & Bros.

McGrath, Alister E. 2008. *The Open Secret: A New Vision for Natural Theology*. Malden, MA: Wiley–Blackwell.

McGrath, Alister E. 2009. *A Fine-Tuned Universe: The Quest for God in Science and Theology*. Louisville, KY: Westminster John Knox.

McGrath, Alister E. 2011. *Surprised by Meaning: Science, Faith, and How We Make Sense of Things*. Louisville, KY: Westminster John Knox.

McGrath, Alister E. 2015. *The Big Question: Why We Can't Stop Talking About Science, Faith, and God*. London: St. Martin's.

McShea, Daniel W. 1991. "Complexity and Evolution: What Everybody Knows." *Biology and Philosophy* 6:303–24.

Moltmann, Jürgen. 1981. *The Trinity and the Kingdom: The Doctrine of God*. Translated by Margaret Kohl. San Francisco: Harper and Row.

Moltmann, Jürgen. 1993. *The Crucified God: The Cross of Christ as the Foundation and Criticism of Christian Theology*. Translated by R. A. Wilson and John Bowden. Minneapolis: Fortress. https://uwerosenkranz.net/?p=2282.

Michener, Charles D. 1949. "Parallelisms in the Evolution of the Saturniid Moths." *Evolution* 3, no. 2: 129–41.

Mivart, St. Georges. 1871. *On the Genesis of Species*. London: Macmillan.

Monod, Jacques. 1997. *Chance and Necessity: An Essay on the Natural Philosophy of Modern Biology*. New ed. London: Penguin.

Nagel, Ernest. 1961. *The Structure of Science*. London: Routledge & Kegan Paul.

Niebuhr, Reinhold. 1964. *The Nature and Destiny of Man: A Christian Interpretation*. 2 vols. New York: Scribner.

Nitecki, Matthew H. 1988. *Evolutionary Progress*. Chicago: University of Chicago Press.

Nitecki, Matthew H. 1990. *Evolutionary Innovations*. Chicago: University of Chicago Press.

Nussbaum, Martha C. 2001. *Upheavals of Thought: The Intelligence of Emotions.* Cambridge: Cambridge University Press.

Nygren, Anders. 1953. *Agape and Eros: The Christian Idea of Love*. Philadelphia: Westminster.

Oord, Thomas Jay. 2004. *Science of Love: The Wisdom of Wellbeing*. Radnor, PA: Templeton

Oord, Thomas Jay. 2007. "Process Answers to Love Questions." In *The Many Facets of Love: Philosophical Explorations*, edited by Thomas Jay Oord, 20–30. Newcastle, UK: Cambridge Scholars.

Oord, Thomas Jay. 2010a. *Defining Love: A Philosophical, Scientific, and Theological Engagement*. Grand Rapids, MI: Brazos.

Oord, Thomas Jay. 2010b. *The Nature of Love: A Theology*. St. Louis, MO: Chalice.

Oord, Thomas Jay, ed. 2010c. *The Polkinghorne Reader: Science, Faith and the Search for Meaning*. London: SPCK.

Oord, Thomas Jay. 2015. *The Uncontrolling Love of God: An Open and Relational Account of Providence*. Downers Grove, IL: IVP Academic.

Oord, Thomas Jay. 2017. "An Essential Kenosis View." In *God and the Problem of Evil: Five Views*, edited by Chad Meister and James K. Dew, 77–95. Downers Grove, IL: InterVarsity.

Oord, Thomas Jay. 2019. *God Can't: How to Believe in God and Love After Tragedy, Abuse, and Other Evils*. Grasmere, ID: Sacra Sage.

Ospovat, Dov. 1981. *The Development of Darwin's Theory: Natural History, Natural Theology and Natural Selection, 1838-1859*. Cambridge: Cambridge University Press.

Owen, Richard. 1849. *On the Nature of Limbs*. London: John Van Voorst.

Pannenberg, Wolfhart. 1968. *Jesus: God and Man*. Philadelphia: Westminster.

Patitsas, Chrestos. 1982. “Kenosis according to Saint Paul.” *The Greek Orthodox Theological Review* 27: 67–82.

Patterson, C. 1988. “Homology in Classical and Molecular Biology.” *Molecular Biology and Evolution* 5, no. 6 (July): 603–25.

Peacocke, Arthur R. 2001. “The Cost of New Life.” In *The Work of Love: Creation as Kenosis*, edited by John Polkinghorne, 21–42. Grand Rapids, MI: Eerdmans, 2001.

Pearse, John S., and Vicki B. Pearse. 1978. “Vision of Cubomedusan Jellyfishes.” *Science* 199, no. 4327 (January 27): 458.

Peckham, Morse, ed. 1959. *The “Origin of Species” by Charles Darwin: A Variorum Text*. Philadelphia: University of Pennsylvania Press.

Peirce, Charles Sanders. 1932-36. *The Collected Papers of Charles Sanders Peirce*. 6 vols. Edited by Charles Hartshorne and Paul Weiss. Cambridge: Harvard University Press.

Peirce, Charles Sanders. 1992. *The Essential Peirce: Selected Philosophical Writings*. Vol. 1, *(1867-1893)*, edited by Nathan Houser and Christian Kloesel. Bloomington: Indiana University Press.

Peirce, Charles Sanders. 1993. *Reasoning and the Logic of Things: The Cambridge Conferences Lectures of 1898*, edited by Kenneth Lane Ketner. Cambridge, MA: Harvard University Press.

Peirce, Charles Sanders. 1998. *The Essential Peirce: Selected Philosophical Writings*. Vol. 2, *(1893-1913)*, edited by Peirce Edition Project. Bloomington: Indiana University Press.

Peirce, Charles S. 2021. *Logic of the Future: Writings on Existential Graphs*. Volume 2/2, *The 1903 Lowell Lectures*, edited by Ahti-Veikko Pietarinen. Berlin: de Gruyter.

Pinnock, Clark H. 2001. *Most Moved Mover: A Theology of God's Openness*. Grand Rapids, MI: Baker.

Polkinghorne, John C. 1994a. *The Faith of a Physicist: Reflections of a Bottom-Up Thinker*. Princeton: Princeton University Press.

Polkinghorne, John C. 1994b. *Science and Christian Belief: Theological Reflections of a Bottom-Up Thinker*. London: SPCK.

Polkinghorne, John C. 1998. *Science and Theology: An Introduction*. London: SPCK.

Polkinghorne, John C., ed. 2001a. *The Work of Love: Creation as Kenosis*. Grand Rapids, MI: Eerdmans.

Polkinghorne, John C. 2001b. "Kenotic Creation and Divine Action." In *The Work of Love: Creation as Kenosis*, edited by John C. Polkinghorne, 90–106. Grand Rapids, MI: Eerdmans.

Polkinghorne, John C. 2005. *Science and Providence: God's Interaction with the World*. Philadelphia: Templeton Foundation.

Pollard, William G. 1958. *Chance and Providence: God's Action in a World Governed by Scientific Law*. London: Faber and Faber.

Popper, Karl R. 1959. *The Logic of Scientific Discovery*. New York: Harper & Row.

Popper, Karl R. 1962. *Conjectures and Refutations: The Growth of Scientific Knowledge*. New York: Basic Books.

Popper, Karl R. 1972. *Objective Knowledge: An Evolutionary Approach*. New York: Oxford University Press.

Post, Stephen G. 2003. *Unlimited Love: Altruism, Compassion, and Service*. Radnor, PA: Templeton Foundation.

Raff, Rudolph A. 1996. *The Shape of Life*. Chicago: University of Chicago Press.

Raup, David M., Stephen Jay Gould, Thomas J. M. Schopf, and Daniel S. Simberloff. 1973. "Stochastic Models of Phylogeny and the Evolution of Diversity." *Journal of Geology* 81, no. 5 (September): 525–42.

Raup, David M., and Stephen Jay Gould. 1974. "Stochastic Simulation and Evolution of Morphology—Towards a Nomothetic Paleontology." *Systematic Zoology* 23, no. 3 (September): 305–22.

Ray, John. 1691. *The Wisdom of God Manifested in the Works of the Creation*. London: Printed for Samuel Smith.

Richard, Lucien. 1997. *Christ: The Self-Emptying of God*. New York: Paulist Press.

Richards, Robert J. 1992. *The Meaning of Evolution: The Morphological Construction and Ideological Reconstruction of Darwin's Theory*. Chicago: University of Chicago Press.

Rolston, Holmes, III. 2001. "Kenosis and Nature." In *The Work of Love: Creation as Kenosis*, edited by John C. Polkinghorne, 43–66. Grand Rapids, MI: Eerdmans.

Rousselot, Pierre. 2002. *The Problem of Love in the Middle Ages: A Historical Contribution*, translated by Alan Vincelette. Corrected by Pol Vandevelde. Milwaukee: Marquette University Press.

Rowe, William L. 2004. *Can God Be Free?* Oxford: Oxford University Press.

Rudwick, Martin J. S. 1970. "The Strategy of Lyell's *Principles of Geology*." *Isis* 61, no. 1 (Spring): 5–33.

Rudwick, Martin J. S. 1972. *The Meaning of Fossils*. New York: Science History.

Ruse, Michael. 1975. "Darwin's Debt to Philosophy: An Examination of the Influence of the Philosophical Ideas of John F. W. Herschel and William Whewell on the Development of

Charles Darwin's Theory of Evolution." *Studies in History and Philosophy of Science* 6, no. 2 (June): 159–81.

Ruse, Michael. 1993. "Evolution and Progress." *Trends in Ecology and Evolution* 8, no. 2 (February): 55–59.

Ruse, Michael. 1995. *Evolutionary Naturalism: Selected Essays*. London: Routledge.

Ruse, Michael. 1996. *Monad to Man: The Concept of Progress in Evolutionary Biology*. Cambridge, MA: Harvard University Press.

Russell, E. S. 1916. *Form and Function*. London: John Murray.

Saint-Hilaire, E. Geoffroy. 1818. *Philosophie anatomique*. Vol. 1, *Des organes respiratoires sous le rapport de la determination et de l'identite de leurs pièces osseuses*. Paris: J.-B. Baillière.

Schweber, Silvan S. 1988. Review of *The Correspondence of the Young Darwin*. *Journal of the History of Biology* 21, no. 3 (Autumn): 501–19.

Seilacher, Adolf. 1984. "Late Precambrian and Early Cambrian Metazoa: Preservational or Real Extinctions." In *Patterns of Change in Earth Evolution*, edited by H. D. Holland and A. R. Trendall, 159–68. Berlin: Springer Verlag.

Short, T. L. 1981. "Peirce's Concept of Final Causation." *Transactions of the Charles S. Peirce Society* 17, no. 4 (Fall): 369–82.

Simmons, Ernest L. 1999. "Toward A Kenotic Pneumatology: Quantum Field Theory and the Theology of the Cross." *CTNS Bulletin* 19, no. 2 (Spring): 10–16.

Simpson, George Gaylord. 1944. *Tempo and Mode in Evolution*. New York: Columbia University Press.

Simpson, George Gaylord. 1945. "The Principles of Classification and a Classification of Mammals." *Bulletin of the American Museum of Natural History* 85:1–350. http://hdl.handle.net/2246/1104.

Simpson, George Gaylord. 1949. *The Meaning of Evolution*. New Haven: Yale University Press.

Simpson, George Gaylord. 1960. "The History of Life." In *Evolution After Darwin*. Vol. 1, *The Evolution of Life*, 117–80, edited by Sol Tax. Chicago: University of Chicago Press.

Simpson, George Gaylord. 1961. *Principles of Animal Taxonomy*. New York: Columbia University Press.

Singer, Irving. 1987. *The Nature of Love*. Vol. 1, *Plato to Luther*, 2nd ed. Chicago: University of Chicago Press.

Spencer, Herbert. 1893a. "The Inadequacy of Natural Selection," part 1. *Contemporary Review* 63 (February): 153–66.

Spencer, Herbert. 1893b. "A Rejoinder to Professor Weismann." *Contemporary Review* 64 (December): 893–912.

Stearns, Steven C. 1986. "Natural Selection and Fitness, Adaptation and Constraint." In *Patterns and Processes in the History of Life*, edited by David M. Raup and David Jablonski, 23–44. Berlin: Springer Verlag.

Stebbins, G. L. 1969. *The Basis of Progressive Evolution*. Chapel Hill: University of North Carolina Press.

Stone, Bryan P., and Thomas Jay Oord. 2001. *Thy Nature and Thy Name is Love: Wesleyan and Process Theologies in Dialogue*. Nashville: Kingswood.

Sulloway, Frank J. 1979. "Geographical Isolation in Darwin's Thinking: The Vicissitudes of a Crucial Idea." *Studies in History of Biology* 3:23–65.

Swanson, James. 1997. *Dictionary of Biblical Languages with Semantic Domains: Hebrew (Old Testament)*, electronic ed. Logos Bible Software. Oak Harbor, WA: Logos Research Systems, Inc.

Sweetman, Brendan. 2015. *Evolution, Chance, and God: Understanding the Relationship Between Evolution and Religion*. London: Bloomsbury Academic.

Tattersall, Ian, and Jeffrey Schwartz. 2000. *Extinct Humans*. Boulder, CO: Westview.

Thompson, D'Arcy Wentworth. 1917. *On Growth and Form*. Cambridge: Cambridge University Press.

Todes, Daniel P. 1987. "Darwin's Malthusian Metaphor and Russian Evolutionary Thought, 1859–1917." *Isis* 78, no. 4 (December): 537–51.

Turnbull, W. D. 1978. "Another Look at Dental Specialization in the Extinct Sabre-Toothed Marsupial *Thylacosmilus*, Compared to Its Placental Counterparts." In *Development, Function and Evolution of Teeth*, edited by Percy M. Butler and K. A. Joysey, 319–414. London: Academic Press.

Turner, Alan, and Mauricio Antón. 1977. *The Big Cats and Their Fossil Relatives: An Illustrated Guide to Their Evolution and Natural History*. New York: Columbia University Press.

Vacek, Edward Collins. 1994. *Love, Human and Divine: The Heart of Christian Ethics*. Washington, DC: Georgetown University Press.

Vacek, Edward Collins. 1996. "Love, Christian and Diverse: A Response to Colin Grant." *Journal of Religious Ethics* 24, no. 1 (Spring): 29–34.

Wagoner, Robert E. 1997. *The Meanings of Love: An Introduction to the Philosophy of Love*. Westport, CT: Praeger.

Wake, David B. 1991. "Homoplasy: The Result of Natural Selection, or Evidence of Design Limitations?" *American Naturalist* 138, no. 3 (September): 543–67.

Wald, George, and Stephen Rayport. 1977. "Vision in Annelid Worms." *Science* 196, no. 4297 (June 24): 1434–39.

Wang, Henry. 2005. "Rethinking the Validity and Significance of Final Causation: From the Aristotelian to the Peircean Teleology." *Transactions of the Charles S. Peirce Society* 41, no. 3 (Summer): 603-625.

Ward, Keith. 1996. *God, Chance, and Necessity*. Oxford: Oneworld.

Weismann, Augustus. 1893. "The All-Sufficiency of Natural Selection: A Reply to Herbert Spencer," part 1. *Contemporary Review* 64 (September): 309–38.

Whitehead, Alfred North. 1979. *Process and Reality: An Essay in Cosmology*, corrected ed. Edited by David Ray Griffin and Donald W. Sherburne. New York: Free Press.

Wiles, Maurice F. 1981. "Farrer's Concept of Double Agency." *Theology* 84 (700): 243–49.

Wiles, Maurice F. 1986. *God's Action in the World: The Bampton Lectures for 1986.* London: SCM Press.

Williams, Andrew Ray. 2021. *Boundless Love: A Companion to Clark H. Pinnock's Theology*. Eugene, OR: Wipf and Stock.

Williams, George C. 1966. *Adaptation and Natural Selection*. Princeton: Princeton University Press.

Williams, George C. 1989. "A Sociobiological Expansion of Evolution and Ethics." In *Evolution and Ethics*, edited by J. Paradis and G. C. Williams, 179–214. Princeton: Princeton University Press.

Wilson, Edward O. 1975. *Sociobiology: The New Synthesis*. Cambridge, MA: Harvard

University Press.

Wood, D. R. W., ed. 1996. *New Bible Dictionary*. 3rd ed. Leicester, England: Inter-Varsity Press.

Wojtyla, Karol. 1993. *Love and Responsibility*. Translated by H. T. Willetts. San Francisco: Ignatius Press.

Yong, Amos. 2000. *Discerning the Spirit(s): A Pentecostal-Charismatic Contribution to Christian Theology of Religions*. Sheffield: Sheffield Academic Press.

Yong, Amos. 2002. *Spirit-Word-Community: Theological Hermeneutics in Trinitarian Perspective*. Eugene, OR: Wipf and Stock.

Yong, Amos. 2003. *Beyond the Impasse: Toward a Pneumatological Theology of Religions*. Grand Rapids, MI: Baker Academic.